

# **MSD** **IGNITION** **INSTALLATION INSTRUCTIONS**

## **MSD Marine Ignitions** **6M-2, PN 6460 and 6M-2L, PN 6560**

### **Parts Included:**

1 - MSD Ignition

1 - Harness, PN 64601

4 - #8 x 3/4" Screws

3 - Wire Splicers

2 - Spade Connectors

### **6M-2L Only**

3 - RPM Modules, 4,000, 6,000 and 8,000

**WARNING:** During installation, disconnect the battery cables. When disconnecting the battery always remove the Negative cable first and install it last.

**Note:** Solid Core spark plug wires **cannot** be used with an MSD Ignition.

**Note:** An MSD 6M-2 **cannot** be used with distributorless ignition systems (DIS).

## **THEORY OF 6 SERIES IGNITION**

### **CAPACITIVE DISCHARGE**

The MSD 6M-2 Series Ignitions feature a capacitive discharge ignition design. The majority of stock ignition systems are inductive ignitions. In an inductive ignition, the coil must store energy and step up the voltage to maximum strength in between each firing. At higher rpm, since there is less time to charge the coil to full capacity, the voltage falls short of reaching maximum energy which results in a loss of power or top end miss.

The MSD Ignition features a capacitor to store the energy as it is quickly charged to 460-480 volts. It then releases all of this energy when the ignition is triggered. With the CD design, the voltage sent to the coil is always at full power even at high rpm.

### **MULTIPLE SPARKS**

The 6M-2 produces full power multiple sparks for each firing of a plug. The number of multiple sparks that occur decreases as rpm increases, however the spark series always lasts for 20° of crankshaft rotation. Above 3,000 rpm there is simply not enough "time" to fire the spark plug more than once, so there is only one powerful spark.

### **6M-2, PN 6460**

The 6M-2 is equipped with a special 4-wire connector that will plug into an optional Rev Limiter, PN 8768. The Soft Touch circuitry provides a smooth and accurate rev limit by dropping the spark to individual cylinders. The Rev Limit is adjustable with special rpm modules in increments of 200 rpm (see page 12).

### **6M-2L, PN 6560**

The 6M2-L has a built-in rev limiter. The rpm limit is adjusted with marine rpm modules (see page 12).

## **GENERAL INFORMATION**

### **BATTERY**

The 6M-2 Series Ignition Control will operate on any negative ground, 12 volt electrical system with a distributor. The MSD can be used with 16 volt batteries and can withstand a momentary 24 volts in case of jump starts. The Ignitions will deliver full voltage with a supply of 10 - 18 volts and will operate with a supply voltage as low as five volts.

## COILS

The MSD 6M-2 Ignition can be used with most stock coils and aftermarket coils designed to replace the stock coils. There are some "race only" coils such as the MSD Pro Power Coil, PN 8201, that **cannot** be used with a 6 Series MSD Ignition Control. For more information on recommended coils, consult the supplied Coil Application Chart or check with the manufacturer of your coil.

## TACHOMETERS

The MSD Ignition features a Tach Output Terminal on the side of the unit. This terminal provides a trigger signal for tachometers, a shift light or other add-on rpm activated devices. The Tach Output Terminal produces a 12 volt square wave signal with a 20% duty cycle.

Some boats with factory tachometers may require a Tach Adapter to operate with the MSD. For more information on Tachometers and MSD Tach Adapters, see the Tachometer Section on page 6.

If your distributor/coil has an inline filter it may cause the tach to drop to zero on acceleration. If this occurs, bypass the filter.

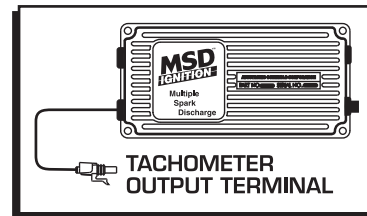


Figure 1 Tach Terminal

## SPARK PLUGS AND WIRES

Spark plug wires are very important to the operation of your ignition system. A good quality, helically wound wire and proper routing are required to get the best performance from your ignition, such as the MSD Heli-Core or 8.5mm Super Conductor Wire.

**Note:** Solid Core spark plug wires cannot be used with an MSD Ignition.

A helically, or spiral wound wire must be used. This style wire provides a good path for the spark to follow while keeping Electro Magnetic Interference (EMI) to a minimum. Excessive EMI, such as the amount that solid core wires produce, will interfere with the operation of the MSD.

**Routing:** Correct routing of the plug wires is also important to performance. Wires should be routed away from sharp edges and engine heat sources. If there are two wires that are next to each other in the engine's firing order, the wires should be routed away from each other to avoid inducing a spark into the other wire. For example, in a Chevy V8, the firing order is 1-8-4-3-6-5-7-2. The #5 and #7 cylinders are next to each other in the engine and in the firing order. If the voltage from the #5 wire is induced into #7 detonation could occur and cause engine damage.

To add more heat protection to your plug wires, MSD offers Pro-Heat Guard, PN 3411. This is a glass woven and silicone coated protective sleeve that you slide over your plug wires. For extra protection of the spark plug boots, MSD offers Pro-Heat Boot Guard, PN 3412.

**Spark Plugs:** Choosing the correct spark plug design and heat range is important when trying to get the best performance possible. Since there are so many engine combinations and manufacturers, MSD does not recommend which plug or gap is exactly right for your application.

It is recommended to follow the engine builder or manufacturer's specification for spark plugs. With that, you can then experiment with the plug gap to obtain the best performance. The gap of the plugs can be opened in 0.005" increments, then tested until the best performance is obtained. MSD judges the plug gap by compression and components:

These examples are just starting points to get you going in the right direction. Every application is different and should be tested and tuned.

Compression	Spark Plug Gap
Up to 10.5:1:	0.050" - 0.060"
10.5:1 - 13.0:1:	0.040" - 0.050"
Above 13.0:1:	0.035" - 0.045"

## **MISCELLANEOUS INFORMATION**

**Welding:** If you are welding on your boat, to avoid the chance of damage, always disconnect both Heavy Power cables of the MSD (You should also disconnect the tach ground wire too).

**Distributor Cap and Rotor:** It is recommended to install a new distributor cap and rotor when installing the MSD Ignition Control. The cap should be clean inside and out especially the terminals and rotor tip.

## **MOUNTING**

The MSD 6M-2 can be mounted in any position in the engine compartment as long as it is away from direct engine heat sources. It is not recommended to mount the unit in a small enclosed area. When you find a suitable location to mount the unit, make sure the wires of the ignition reach their connections. Hold the Ignition in place and mark the location of the mounting holes. Use an 1/8" drill bit to drill the holes. Use the supplied self tapping screws to mount the box.

## **WIRING**

### **GENERAL WIRING INFORMATION**

**Wire Length:** All of the wires of the MSD Ignition may be shortened as long as quality connectors are used or soldered in place. To lengthen the wires, use one size bigger gauge wire (10 gauge for the power leads and 16 gauge for the other wires) with the proper connections. All connections must be soldered and sealed. MSD offers Weathertight connectors and terminals separately.

**Grounds:** A poor ground connection can cause many frustrating problems. When a wire is specified to go to ground, it should be connected to the battery negative terminal, engine block or chassis. There should always be a ground strap between the engine and the chassis. Always securely connect the ground wire to a clean, paint free metal surface.

**Ballast Resistor:** If your engine has a ballast resistor in line with the coil wiring, it is not required with the MSD (though it is not necessary to bypass it). This is because the MSD receives its **main power** directly from the battery.

## ROUTING WIRES

The MSD wires should be routed away from direct heat sources such as exhaust manifolds and headers and any sharp edges. The trigger wires should be routed separate from the other wires and spark plug wires. It is best if they are routed along a ground plane such as the block or firewall which creates an electrical shield. The magnetic pickup wires should always be routed separately and should be twisted together to help reduce extraneous interference.

## WIRE FUNCTIONS

<b>Power Leads</b>	These are the two heavy gauge wires (12 gauge) and are responsible for getting direct battery voltage to the Ignition. The ignition has an internal fuse so no fuse is necessary.
<b>Heavy Red</b>	This wire connects directly to the battery positive (+) terminal or to a positive battery junction or the positive side of the starter solenoid. <b>Note:</b> Never connect to the alternator.
<b>Heavy Black</b>	This wire connects to a good ground, either at the battery negative (-) terminal or to the engine.
<b>Red</b>	Connects to a switched 12 volt source. Such as the ignition key or switch.
<b>Orange</b>	Connects to the positive (+) terminal of the coil. <b>This is the only wire that makes electrical contact with the coil positive terminal.</b>
<b>Black</b>	Connects to the negative (-) terminal of the coil. <b>This is the only wire that makes electrical contact with the coil negative terminal.</b>
<b>Trigger Wires</b>	There are two circuits that can be used to trigger the MSD Ignition; a Points circuit (White wire) and a Magnetic pickup circuit (Violet and Green wires). The two circuits will <b>never</b> be used together.
<b>White</b>	This wire is used to connect to the points, electronic ignition amplifier output or to the Yellow wire of an MSD Timing Accessory. <b>When this wire is used, the Magnetic pickup connector is not used.</b>
<b>Violet and Green (Magnetic Pickup Connector)</b>	These wires are routed together in one harness to form the Magnetic pickup connector. The connector plugs directly into an MSD Marine Distributor. It will also connect to factory magnetic pickups or other aftermarket pickups. The Violet wire is positive (+) and the Green is negative (-). <b>When these wires are used, the White wire is not.</b>

The chart shows the polarity of other common magnetic pickups. If using a different magnetic pickup. MSD offers a 2-pin Weathertight Connector as PN 8173.

Distributor	Common Mag Pickup Wires Colors	
	Mag+	Mag-
MSD	Org/Blk	Vio/Blk
MSD Crank Trigger	Violet	Green
Ford	Orange	Violet
Accel <sup>46/48000</sup> Series	Org/Blk	Vio/Blk
Accel <sup>51/61000</sup> Series	Red	Black
Chrysler	Org/Wht	Black
Mallory	Org/Blk	Vio/Blk

Figure 2 Common Mag Pickup Wires.

**WARNING:** The MSD 6M-2 Ignition is a capacitive discharge ignition. High voltage is present at the coil primary terminals. Do not touch the coil or connect test equipment to the terminals.

**PRESTART CHECK LIST**

- The only wires connected to the coil terminals are the MSD Orange to coil positive and Black to coil negative.
- The small Red wire of the MSD is connected to a switched 12 volt source.
- The MSD power leads are connected directly to the battery positive and negative terminals.
- The battery is connected and fully charged if not using an alternator.
- The engine is equipped with at least one ground strap.

**THEFT DETERRENT**

The MSD provides the opportunity to easily install a theft deterrent kill switch (Figure 3).

**White Wire Trigger**

When using the WHITE wire to trigger the MSD, install a switch across the magnetic pickup VIOLET wire to ground. When the VIOLET wire is grounded, the engine will crank but not start.

**Magnetic Pickup Trigger**

When using the mag pickup to trigger the MSD, install a switch to the WHITE wire and the other side to ground. When the WHITE wire is grounded, the engine will crank but will not start.

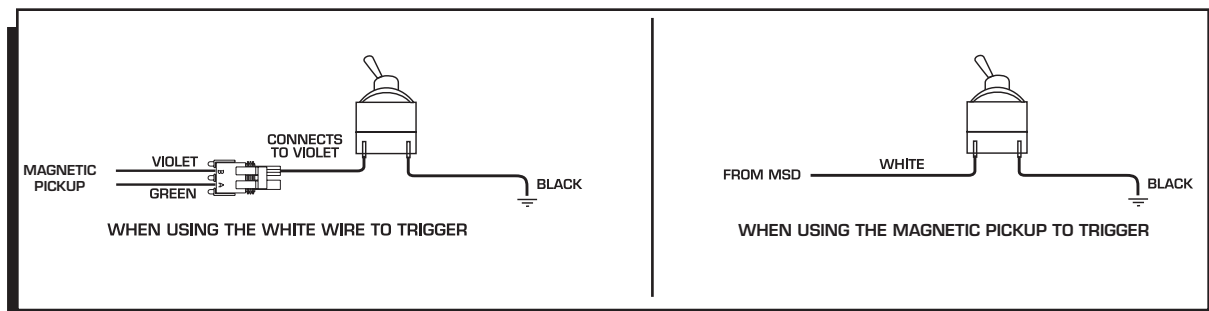


Figure 3 Connecting a Theft Deterrent Switch Through the MSD Ignition.

## TROUBLESHOOTING

Every MSD Ignition undergoes numerous quality control checks including a four hour burn-in test. If you experience a problem with your MSD, our research has shown that the majority of problems are due to improper installation or poor connections.

### TACH/FUEL ADAPTERS

If your tachometer does not operate correctly or if you experience a no-run situation with your foreign vehicle you probably need an MSD Tach Adapter. The chart below lists common tachometers and if an Adapter is necessary.

<b>Tachometer Compatibility List</b>		
<b>AFTERMARKET TACHOMETER</b>	<b>WHITE WIRE TRIGGER</b>	<b>MAGNETIC TRIGGER CONNECTOR</b>
AUTOGAGE	8910	8920
AUTOMETER	NONE	NONE
FORD MOTORSPORTS	NONE	NONE
MALLORY	NONE	NONE
MOROSO	NONE	NONE
STEWART	8910	8920
S.W. & BI TORX	NONE	NONE
SUN	8910	8920
VDO	NONE	NONE
CHRYSLER	8910	8920
FORD (Before 1976)	8910	8920
FORD (After 1976)	8910	8920
GENERAL MOTORS	Bypass In-Line Filter	Bypass In-line filter
IMPORTS	8910	8920

Note: On the list above, the trigger wire on tachometers that are marked NONE may be connected to the Tach Output Terminal on the MSD 6 Series Ignition Unit using the supplied Female Faston Receptacle.

### INOPERATIVE TACHOMETERS

If your tachometer fails to operate with the MSD installed you may need an MSD Tach Adapter. Before getting an Adapter, try connecting your tachometer trigger wire to the tach output terminal on the side of the MSD. This output produces a 12 volt, square wave (see page 2). If the tach still does not operate, you will need a Tach Adapter. There are three Tach Adapters:

**PN 8920:** If you are using the Magnetic pickup connector (Green and Violet wires) to trigger the MSD, you will need the PN 8920.

**PN 8910:** If your tachometer was triggered from the coil negative terminal (voltage trigger) and you are using the White wire to trigger the MSD you will need the PN 8910. This is for use on non-current limiting ignitions, originally equipped with a ballast resistor.

**PN8910-EIS:** When using the White wire of the MSD, but on ignition systems that limit the current (non-ballast resistor equipped).

**+BALLAST RESISTOR**

If you have a current triggered tach (originally coil positive) and use the White wire of the MSD, you can purchase a Chrysler Dual Ballast Resistor (used from 1973 - 1976) and wire it as shown in Figure 4.

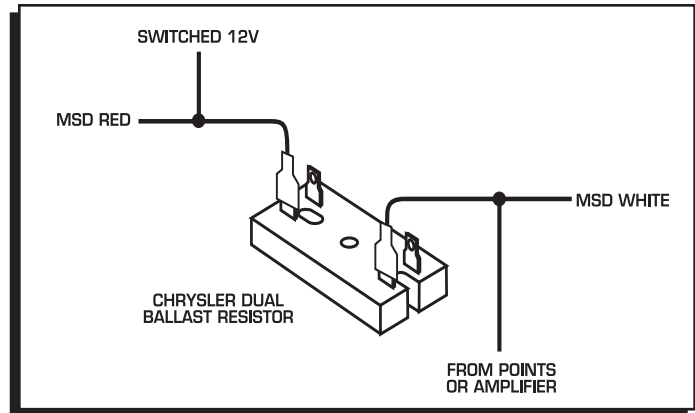


Figure 4 Wiring the Dual Ballast Resistor.

**ENGINE RUN-ON**

If your engine continues to run even when the ignition is turned Off you are experiencing engine Run-On. This usually only occurs on older boats with an external voltage regulator. Because the MSD receives power directly from the battery, it does not require much current to keep the unit energized. If you are experiencing run-on, it is due to a small amount of voltage going through the charging lamp indicator and feeding the small Red wire even if the key is turned off.

**Early Ford and GM:** To solve the Run-On problem, a Diode is supplied with the MSD in the parts bag. By installing this Diode in-line of the wire that goes to the Charging indicator, the voltage is kept from entering the MSD. Figure 5 shows the proper installation for early Ford and GM engines.

**Note:** Diodes are used to allow voltage to flow only one way. Make sure the Diode is installed facing the proper direction (as shown in Figure 5).

**Ford:** Install the Diode in-line to the wire going to the #1 terminal.

**GM:** Install the Diode in-line to the wire going to terminal #4.

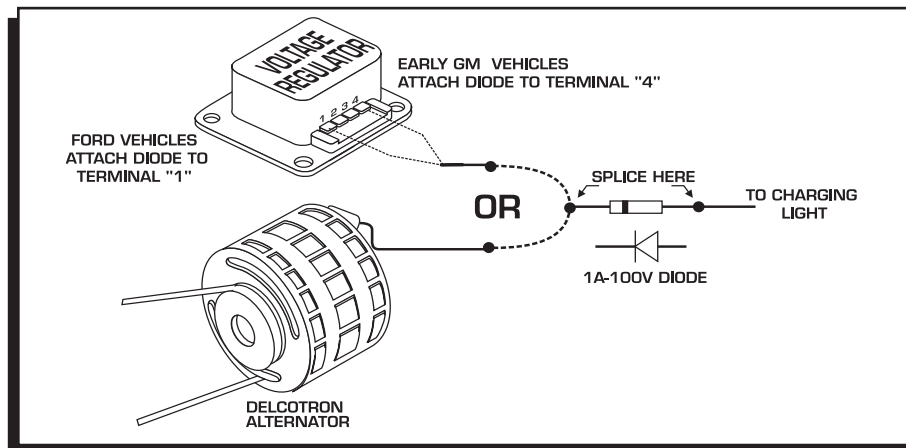
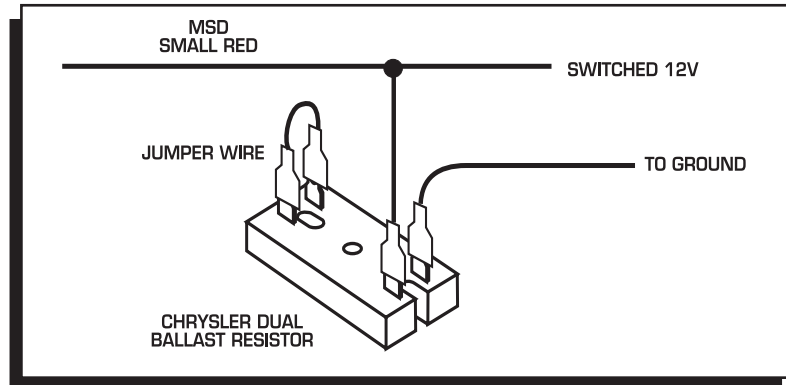


Figure 5 Installing the Diode to fix Run-On.

**GM 1973 - 1983 with Delcotron Alternators**

GM Delcotron Alternators use an internal voltage regulator. Install the Diode in-line on the smallest wire exiting the alternator (Figure 5). It is usually a Brown wire.

**Most other applications:** On other applications where engine Run-On is experienced, a Resistor can be put in-line to the MSD's small Red wire (Figure 6). This resistor will keep voltage from leaking through to the MSD unit.



**Figure 6 Wiring the Dual Ballast Resistor for Run-On.**

## MISSES AND INTERMITTENT PROBLEMS

Experience at the races has shown that if your engine is experiencing a miss or hesitation at higher rpm, it is usually not directly ignition. Most probable causes include a coil or plug wire failure, arcing from the cap or boot plug to ground or spark ionization inside the cap. Several items to inspect are:

- Always inspect the plug wires at the cap and at the plug for a tight connection and visually inspect for cuts, abrasions or burns.
- Inspect the Primary Coil Wire connections. Because the MSD is a Capacitive Discharge ignition and it receives a direct 12 volt source from the battery, there will not be any voltage at the Coil Positive (+) terminal even with the key turned On. During cranking or while the engine is running, very high voltage will be present and no test equipment should be connected.

**WARNING:** Do not touch the coil terminals during cranking or while the engine is running.

- Make sure that the battery is fully charged and the connections are clean and tight. If you are not running an alternator this is an imperative check. If the battery voltage falls below 10 volts during a race, the MSD output voltage will drop.
- Is the engine running lean? Inspect the spark plugs and complete fuel system.
- Inspect all wiring connections for corrosion or damage. Remember to always use proper connections followed by soldering and seal the connections completely.

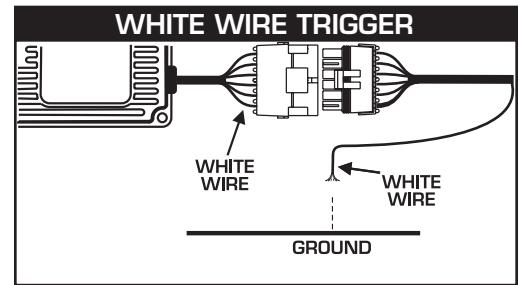
If everything checks positive, use the following procedure to test the ignition for spark. MSD also offers an Ignition Tester, PN 8998. This tool allows you to check your complete ignition system while it is in the car as well as the operation of rpm limits, activated switches and shift lights.



**CHECKING FOR SPARK**

**If triggering the ignition with the White wire:**

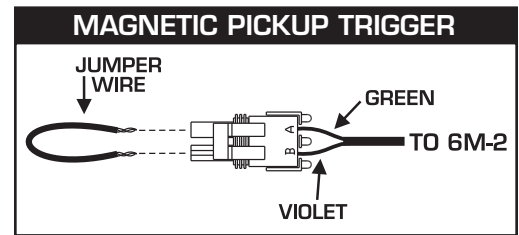
1. Make sure the ignition switch is in the "Off" position.
2. Remove the coil wire from the distributor cap and set the terminal approximately 1/2" from ground.
3. Disconnect the MSD White wire from the distributor's points or ignition amplifier.
4. Turn the ignition to the On position. Do not crank the engine.
5. Tap the White wire to ground several times (it takes several times to trigger). When the wire is removed from ground, a spark should jump from the coil wire to ground. If spark is present, the ignition is working properly. If there is no spark skip to step 6 below:



**Figure 7 Checking for Spark with the White Wire.**

**If triggering with the Magnetic Pickup:**

1. Make sure the ignition switch is in the "Off" position.
2. Remove the coil wire from the distributor cap and set the terminal approximately 1/2" from ground.
3. Disconnect the MSD magnetic pickup wires from the distributor.
4. Turn the ignition to the On position. Do not crank the engine.
5. With a small jumper wire, short the MSD's Green and Violet magnetic pickup wires together several times (it takes several times to trigger). A spark should jump from the coil wire to ground. If spark is present, the ignition is working properly. If there is no spark skip to step 6 below:

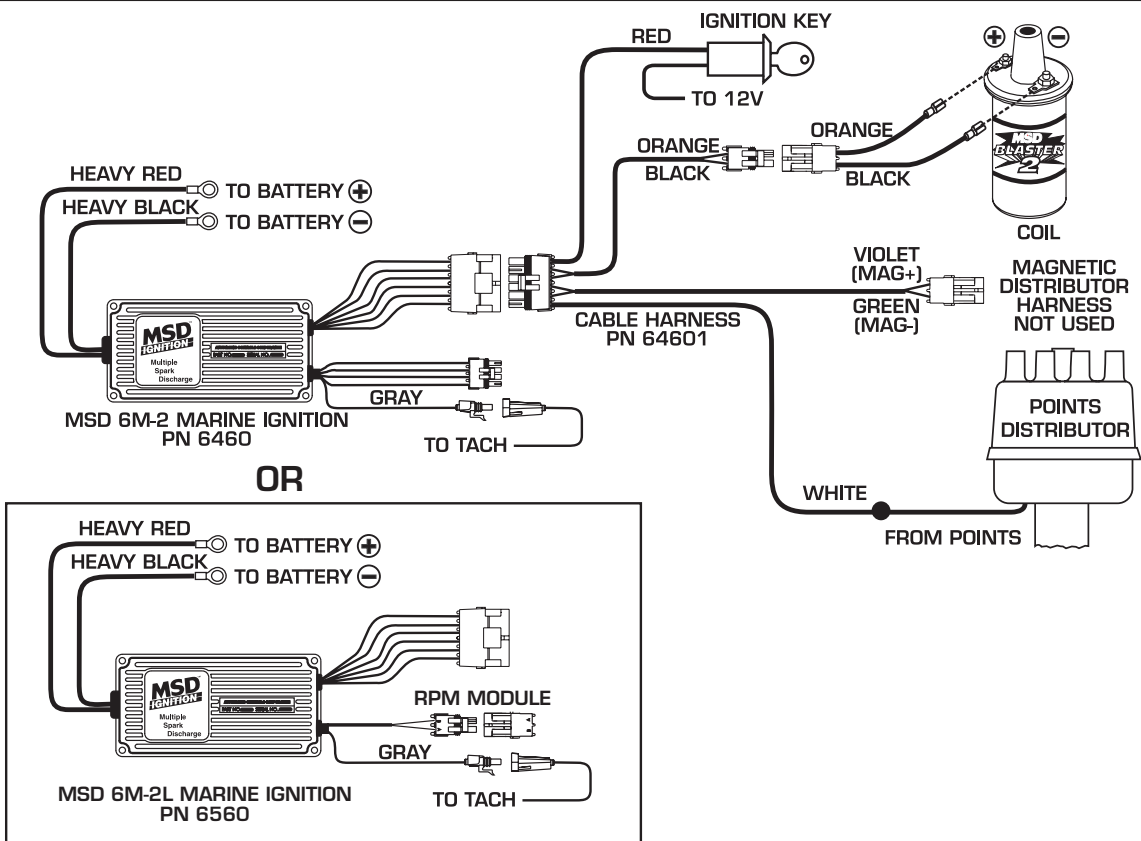


**Figure 8 Checking for Spark with Magnetic Pickup.**

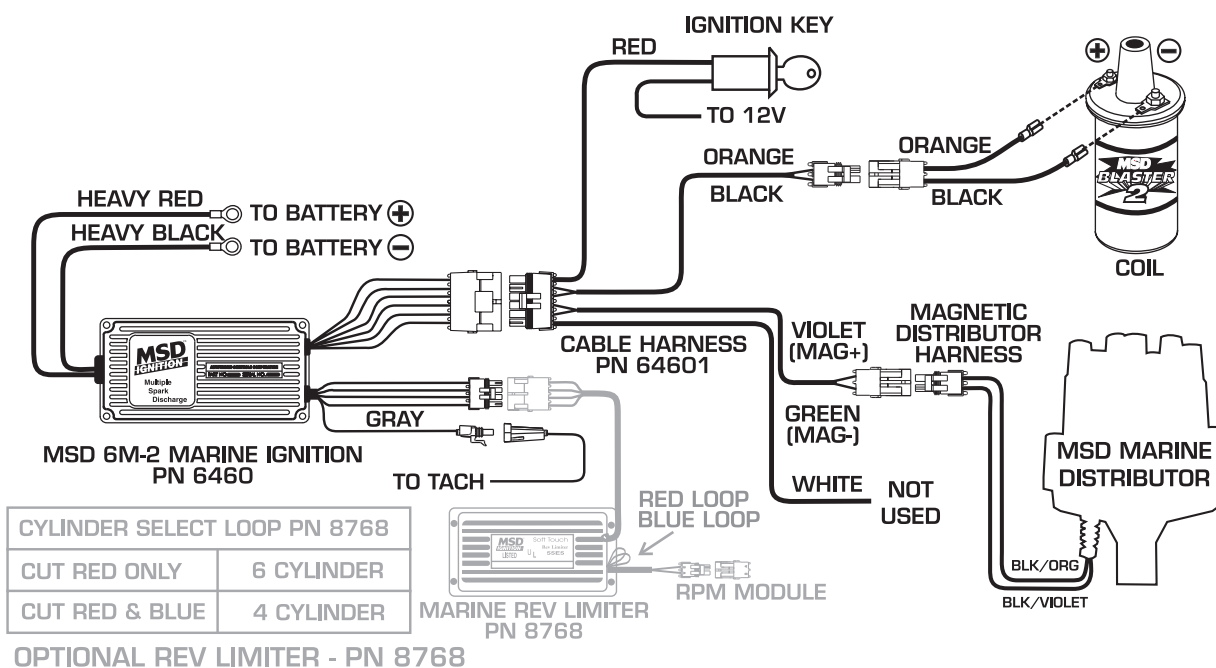
**6. If there is no spark:**

- A. Inspect all of the wiring.
- B. Substitute another coil and repeat the test. If there is now spark, the coil is at fault.
- C. If there is still no spark, check to make sure there is 12 volts on the small Red wire from the MSD when the key is in the On position. If 12 volts is not present, find another switched 12 volt source and repeat the test.
- D. If, after following the test procedures and inspecting all of the wiring, there is still no spark, the MSD Ignition is in need of repair. See the Warranty and Service section for information.

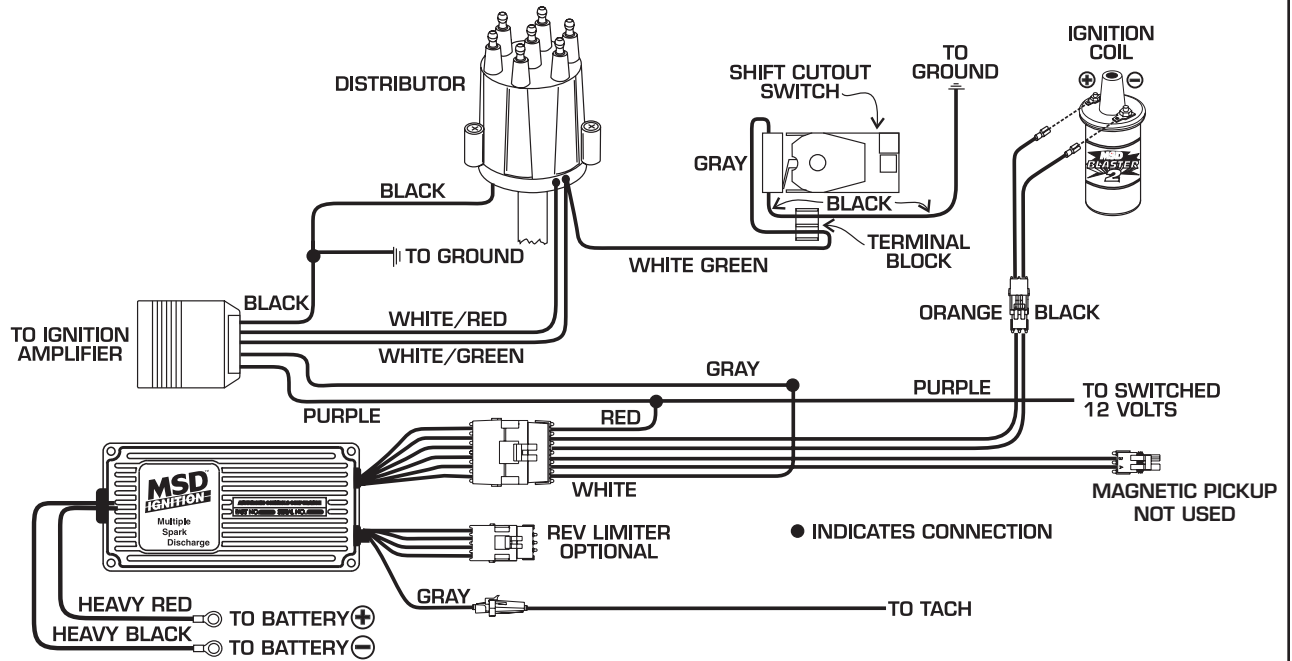
**MSD SYSTEMS MSD Marine Ignition to Points Ignition System**



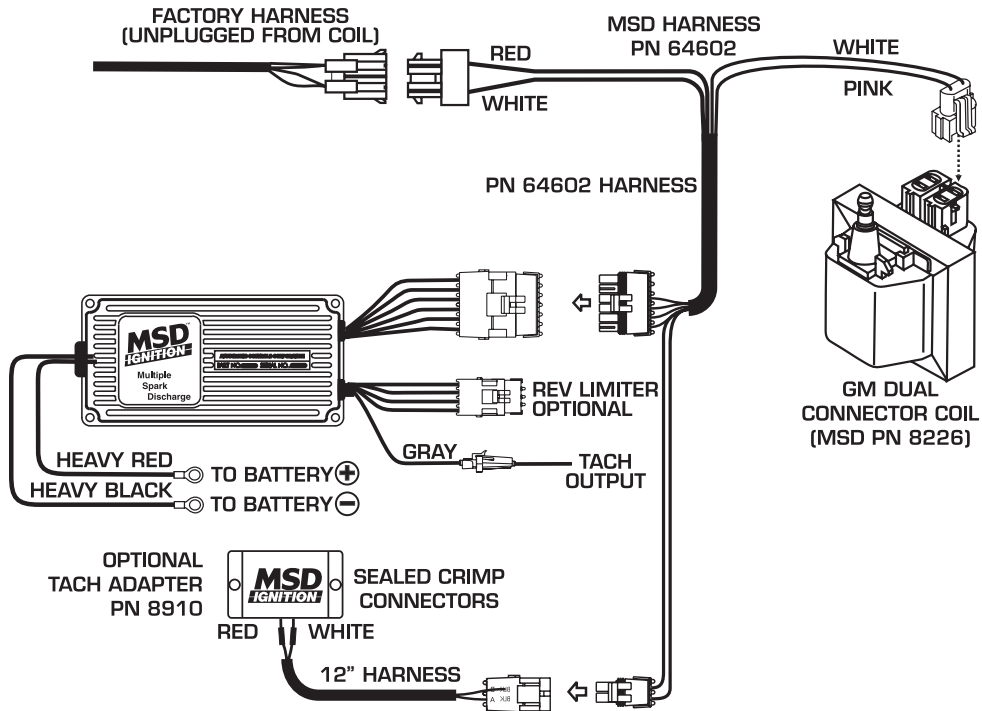
**MSD SYSTEMS MSD Marine Ignition to Magnetic Pickup Distributor**



**MSD SYSTEMS MSD Marine Ignition to Mercruiser Electronic Ignition**



**MSD SYSTEMS MSD 6M-2 to GM Dual Connector Coil**





# INSTALLATION INSTRUCTIONS

## MODULE KITS

- Module Kit, 4,000 RPM Series ..... PN 87446
- Module Kit, 5,000 RPM Series ..... PN 87456
- Module Kit, 6,000 RPM Series ..... PN 87466
- Module Kit, 7,000 RPM Series ..... PN 87476
- Module Kit, 8,000 RPM Series ..... PN 87486