

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

## **MSD Zero-Cross Distributor** **Chevrolet - PN 83971**

### **Parts Included:**

1 – Distributor

1 – Gear Lubricant

1 – Gasket

2 – O-Rings

1 – Hold Down & Hardware

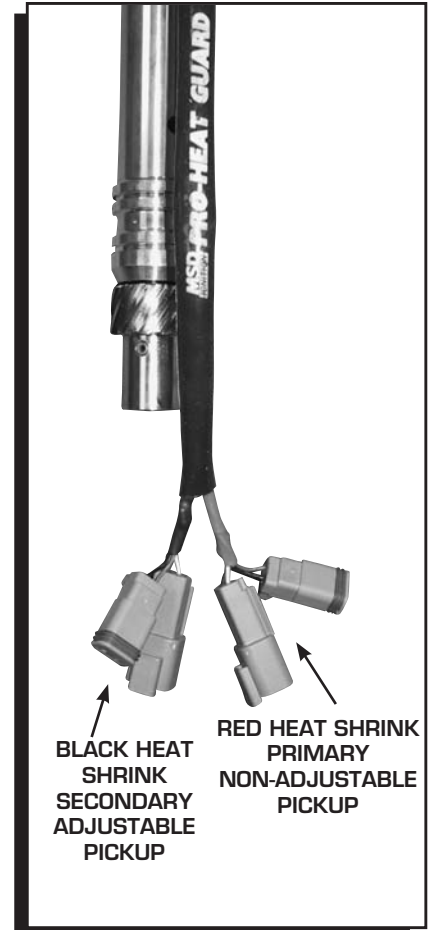
### **IMPORTANT**

The Separate Pickup Zero-Cross Distributors use two completely separate circuits for the primary and secondary trigger pickups. These distributors are easily identified by having four 2-Pin Deutsch connectors coming from its harness (Figure 1). Notice that the wiring going to the Deutsch connectors is shrouded in either Red or Black heat shrink. The Red indicates the primary (fixed) pickup. The Black indicates the secondary (adjustable) pickup.

These Distributors require the Single Channel Electronic Interface Box, PN 83581. Two Boxes are required to run a redundant ignition system (one for each pickup).

The MSD Zero-Cross Distributors are the most advanced racing distributors available. Take the time to read these instructions thoroughly before installing the distributor. There are a variety of adjustments that can be made to improve the performance of your engine and should be understood prior to running the engine.

To take full advantage of the adjustable features it is recommended to use a distributor spin machine or equivalent. With a degree wheel and pointer, you will be able to easily and accurately set the timing of each cylinder as well as the position of the secondary pickup.



**Figure 1 Separate Pickup Connectors.**

### **INTERFACE CONTROL BOX**

Two Single Channel Interface Control Boxes, PN 83581, must be used with the Separate Pickup Zero-Cross Distributors. This produces two completely separate ignition systems. This Control Box converts the unique zero-cross output signal to a signal that is compatible with existing MSD Ignition Controls.

The Interface Control Box features two LEDs under its cover (Figure 2). These LEDs are useful when setting up the individual timing and the secondary pickup position. Used in conjunction with a distributor machine the Interface Box also provides a convenient way to set up the adjustable secondary pickup and the cylinder-to-cylinder timing.

The Red LED is useful when setting up the individual cylinder magnet assemblies on a distributor machine. With the distributor and Interface Control wired to 12 volts and ground, the distributor shaft can be rotated by hand and the Red LED will light when each cylinder's magnet tab triggers the pickup. Each magnet tab can then be adjusted to the engine's specifications.

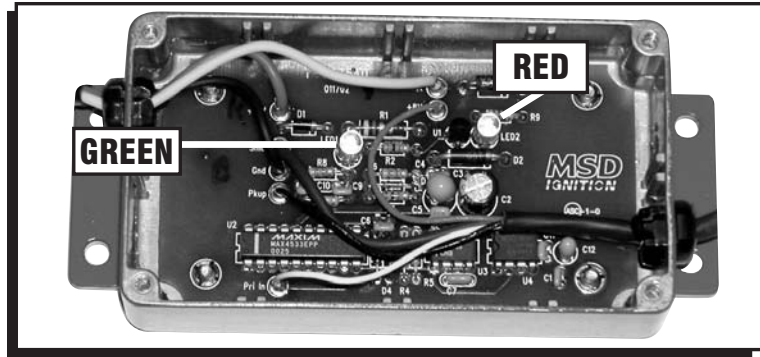


Figure 2 The Interface Module's LEDs.

<b>GREEN</b>	Power On indicator. This will illuminate when the controller receives 12 volts.
<b>RED</b>	Trigger signal indicator. This LED will illuminate with each trigger signal. This is useful when setting up the secondary pickup or individual magnet trigger tabs on a distributor spin fixture. This procedure is outlined in the distributor instructions.

## WIRING

These Distributors have four 2-wire Deutsch Connectors that connect to the matching connector of the Interface Controller. The Red Sleeve indicates the non-adjustable primary pickup. The Black Sleeve indicates the adjustable secondary pickup.

The Wires of the Single Channel Interface Control Box, PN 83581, connect as follows:

4-PIN CONNECTOR		
RED		Connects to a switched 12 volt source.
BLACK		Connects to ground.
YELLOW		This is the trigger output wire and connects to the "points" input of the MSD Ignition Control.
2-PIN CONNECTORS		
MALE CONNECTOR		
BLACK	Pin 1	Connect to a common ground.
RED	Pin 2	12-volt input. Connect to switched 12 volts.
FEMALE CONNECTOR		
BROWN	Pin 1	Shielded Ground. Connect to Ground.
WHITE	Pin 2	Trigger Wire. Connect to the points input (White) wire of the Interface Box.

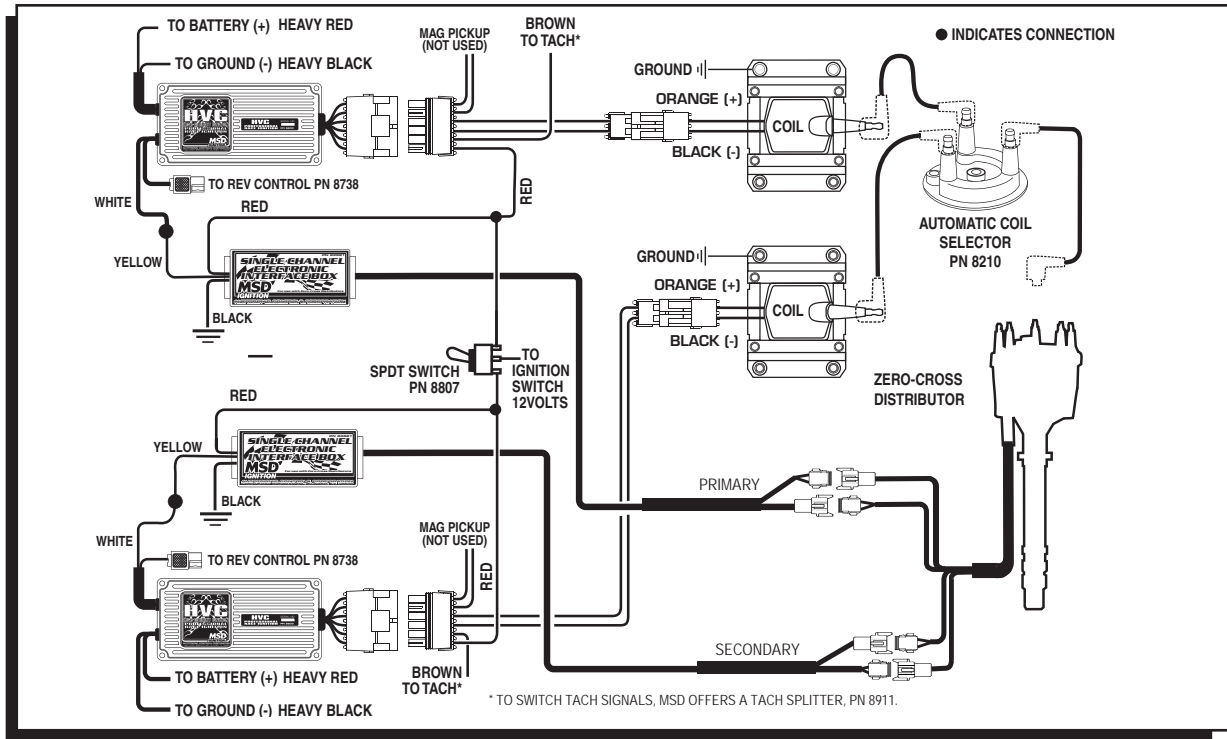


Figure 3 Wiring a Complete Redundant System.

## TIMING ADJUSTMENTS

### INDIVIDUAL CYLINDER TIMING

The Zero-Cross distributor features eight trigger paddles that are responsible for triggering each cylinder of the engine (Figure 4). Each of these paddles can be adjusted up to 6° giving you the ability to alter the timing of each cylinder. The paddles come from the factory aligned in the most advanced position so the timing is equal in each cylinder.

Before adjusting the position of any of the paddles, you will need to call out or engrave which paddle will be used to trigger the number one cylinder. Then you can adjust each paddle by following the engine's firing order. Note that once the timing is set for individual cylinders the distributor must always be installed in the same position every time it is placed in the engine.

To change the timing of each cylinder, loosen the socket head cap screw holding the paddle. A 0.010" feeler gauge represents approximately 1° of crankshaft timing (Figure 5).

**Note:** When adjusting each cylinder's timing, the use of a distributor machine is a big advantage. By using the InterfaceModule's LEDs, adjustments can be set accurately. **Figure 5 Adjusting the Timing for Each Cylinder.**

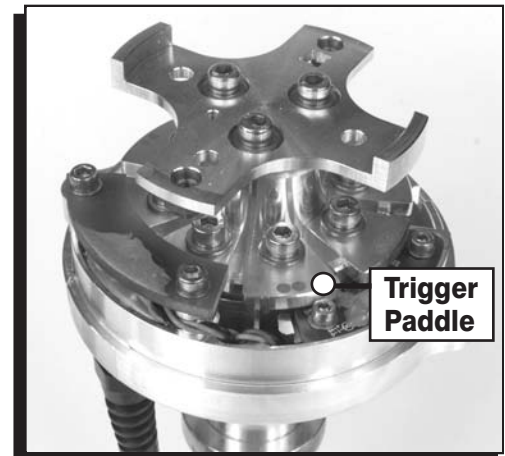


Figure 4 The Individual Trigger Paddles.



## SECONDARY PICKUP ADJUSTMENTS

The Zero-Cross Distributor features a primary and secondary pickup. These are stacked together with the Primary positioned on the bottom. The primary is fixed while the secondary pickup is adjustable  $\pm 4^\circ$ . **The position of the secondary pickup will need to be set to your specifications.**

To adjust the secondary pickup, loosen the two allen head screws on the top pickup enough to slide the pickup (Figure 6). Secure the screws when the desired timing is reached.

**Note:** Loctite or equivalent can be used to enhance locking ability for vibration resistance. Replace the locknuts when they become loose.

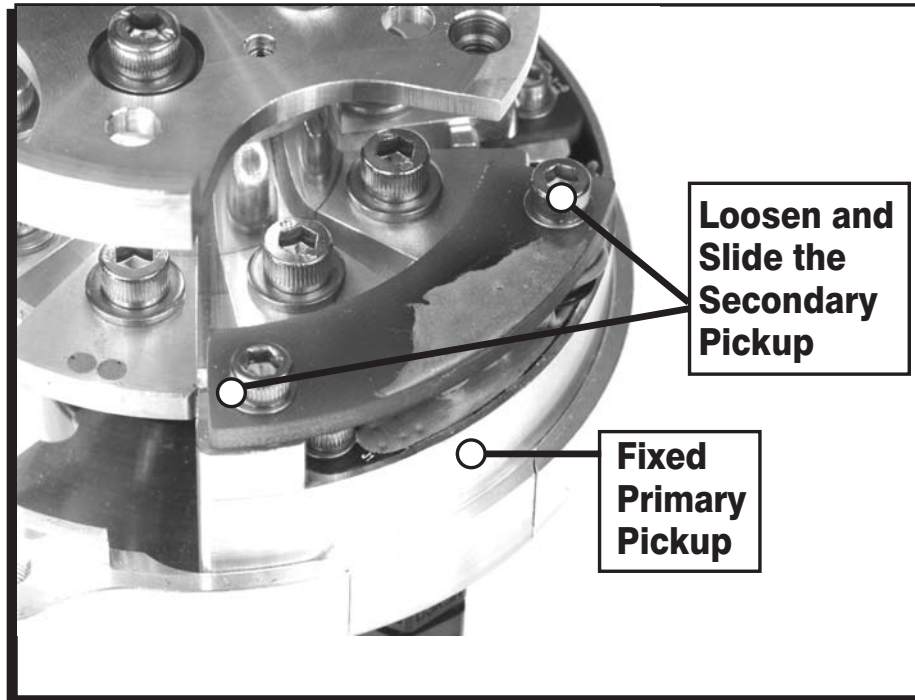


Figure 6 Adjusting the Secondary Pickup.

## SERVICE

MSD designed the Zero-Cross Distributor so it could be completely serviced. Replacement parts for PN 83971 are listed below.

### Service Parts:

Cap and Rotor – PN 8119  
Wire Retainer – PN 8836

Pickup Assemblies  
12" Harness - PN 87591  
36" Harness - PN 87592

Bronze Gear  
Chevrolet\*  
Standard - PN 8471  
+0.006" - PN 8472  
+0.009" - PN 84722  
+0.012" - PN 84723  
+0.015" - PN 84724

\*Note: The Chevrolet Distributor is supplied with a +0.006" bronze gear (PN 8472).

**SERVICE (CONTINUED)**

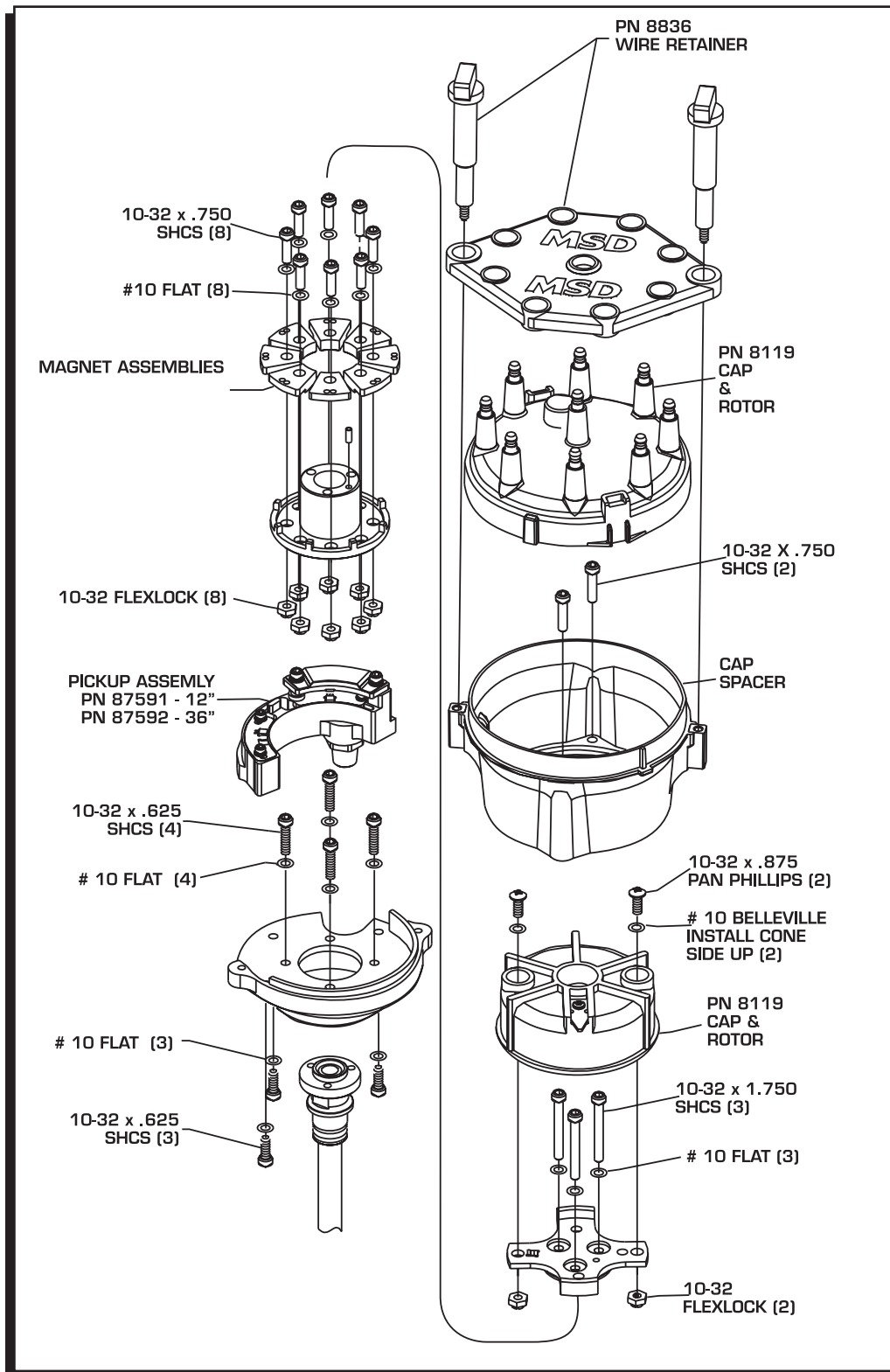


Figure 7 Distributor Head Exploded View.

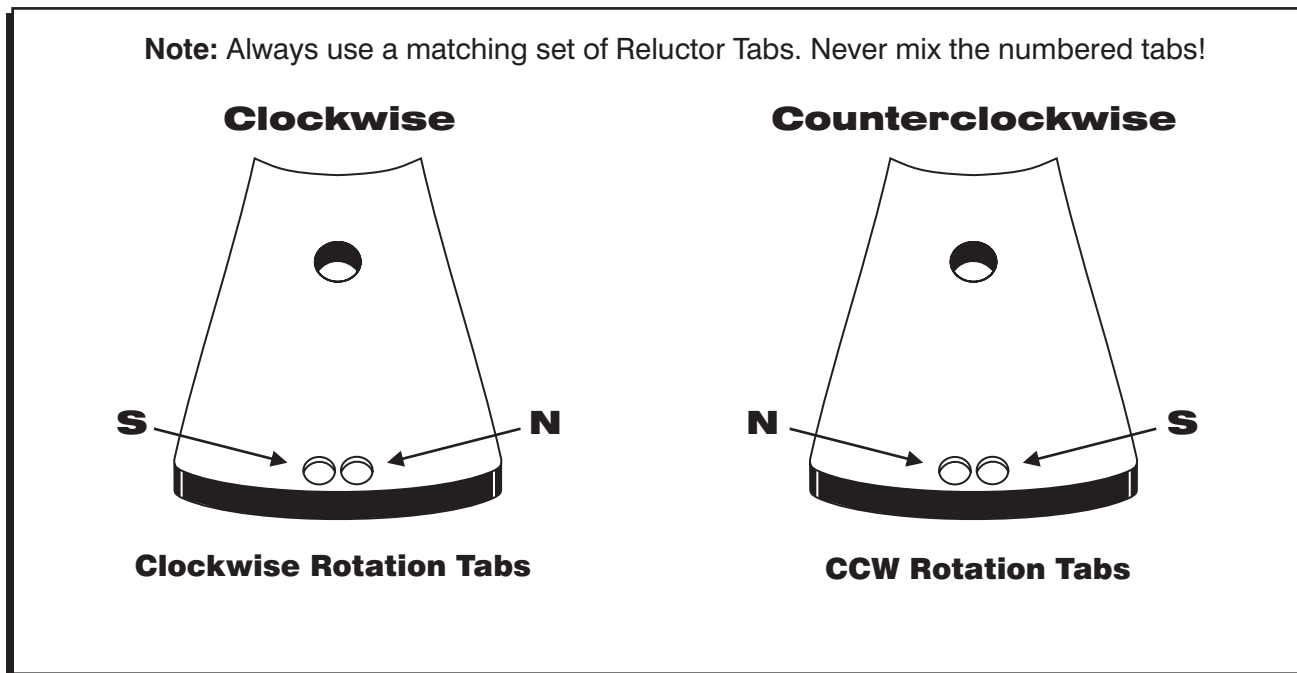
### RELUCTOR MAGNET TABS

The MSD Zero-Cross Distributors use a matched set of Reluctor Tabs to trigger each cylinder. Every Reluctor Tab is tested and graded by MSD technicians before being installed on a distributor or in a Replacement Tab Kit. This process ensures that the Tabs are always a matched set. **Always use a matching set of Reluctor Tabs.**

Each Reluctor Tab has two magnets, one facing north, the other south. The rotation of the distributor determines the orientation of the magnets during assembly. The south pole always leads into the pickup. A CW rotation distributor will have the south pole on the left side when looking down at the Tab. Conversely, a CCW rotation distributor will have the south pole on the right side when looking down at the Tab. (Figure 8).

The Reluctor Tabs are also divided into two groups determined by the amount of timing variance that occurs when switching from the primary to the secondary pickup (testing limit is within 0.5°). MSD engraves a group number in each Tab, 1 – 4, to ensure a matching set. A complete set must always be used together.

**Note:** When changing a complete set of Tabs (for example a set of #1 to #2 tabs) adjusting the secondary pickup may be necessary.



**Figure 8 Reluctor Tab Magnet Placement.**

**Note:** Always use a matching set of Reluctor Tabs. Never mix the numbered tabs!

**SERVICE PROCEDURE**

**LOWER HOUSING**

To replace the seals and bearing of the distributor, the lower housing must be heated for disassembly and to achieve proper clearances for assembly. Review the following procedure before starting the service. Figure 9 shows an exploded view of the distributor.

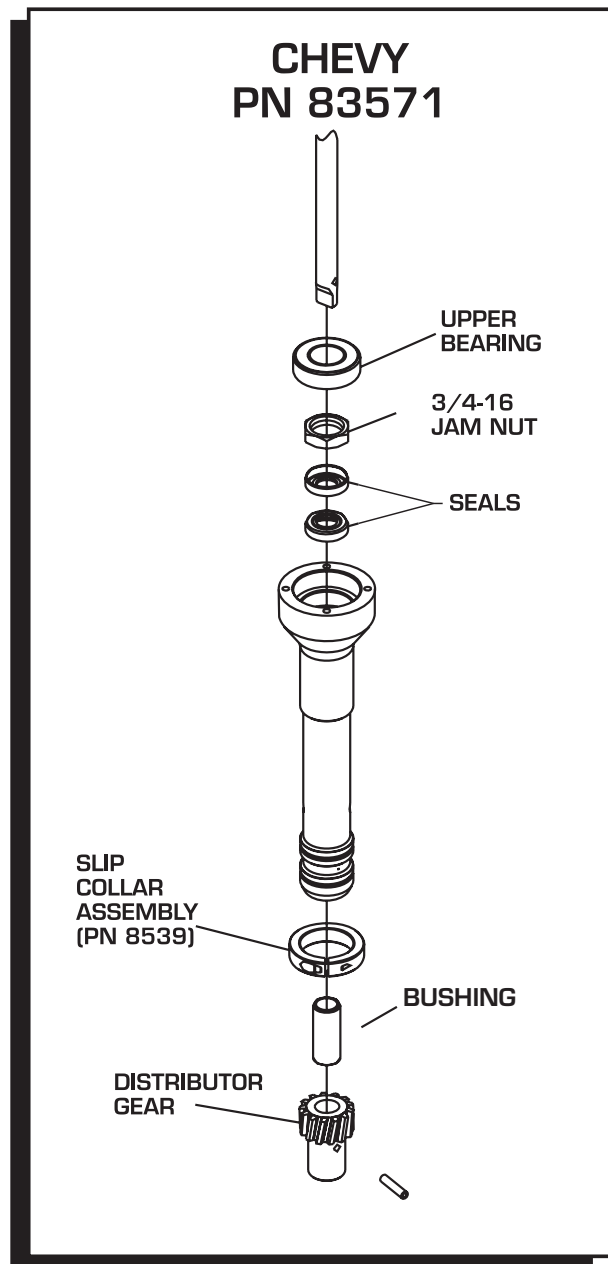
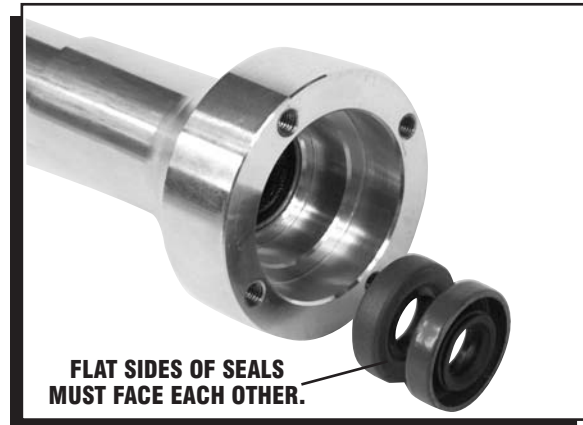


Figure 9 Lower Housing Exploded View.

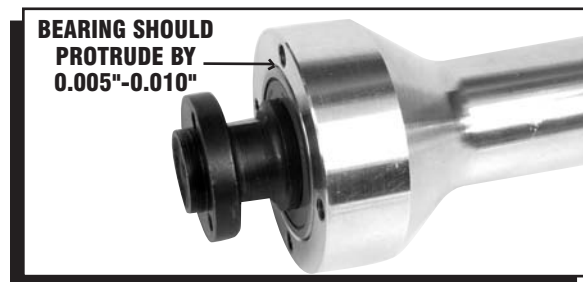
1. Remove the upper housing of the distributor by removing the three rotor drive screws and the four upper housing screws (Figure 7).
2. Remove the roll pin and distributor gear.
3. Place the lower housing and shaft assembly in an oven at 300° for approximately 30 minutes. When heated, the shaft and bearing assembly should slide out of the aluminum housing. A slight tap on the shaft may be necessary.
4. Hold the shaft with an 11/16" wrench and use a 1" wrench to remove the bearing jam nut, then remove the bearing.
5. Remove and replace the two seals in the housing. The new seals install with their flat sides facing each other. Lubricate the seals with grease (Figure 10).
6. Place the lower housing in an oven at 250° for approximately 30 minutes.
7. While the lower housing is heating, install the new bearing on the shaft. Apply Blue Loctite to the threads and install the new locknut. A 1" torque adapter will be required to properly torque the nut to 60 lb.-ft. (Figure 11). This tool is available as PN 8T3182 through CAT Tools and Supplies.
8. Install the shaft assembly into the lower housing. It is fully seated when the bearing protrudes approximately 0.005" – 0.010" out of the housing (Figure 12). If the clearance is more, the housing may have cooled too much before the bearing was fully installed.
9. Install the gear and new roll pin to the shaft. Check the clearance between the gear and housing. It should be greater than 0.015" (Figure 13). If this clearance is under 0.015", the bearing may not be seated properly.
10. Assemble the upper housing.



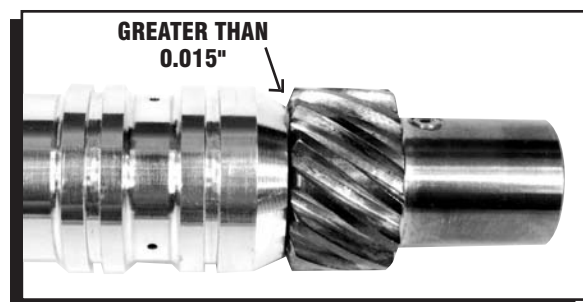
**Figure 10 Installing New Seals.**



**Figure 11 Installing the New Bearing and Lock Nut.**



**Figure 12 Checking Bearing to Housing Clearance.**



**Figure 13 Checking Gear to Housing Clearance.**



## **IGNITION TRIGGERING**

The MSD Zero-Cross Distributor features a unique trigger method that is incredibly steady at any rpm and accurate between the primary and secondary pickups. Magnetic pickups produce reliable signals, however there is an inherent timing retard that occurs as rpm increases. As a result the ignition control must have a compensation circuit built into it. This compensation circuit advances the signal to offset the retard in the pickup.

Slight variances in the compensation circuits and in the pickups can cause timing differences between the primary and secondary ignitions on a dual setup. Timing can be set on the primary ignition and then vary when the switch is made to the secondary unit. This is due to slightly different compensation circuit/pickup relationships.

The Zero Cross distributor incorporates pickups that have an output that does not vary with RPM (the output signal is neither advanced or retarded as RPM increases). This eliminates the need for a compensation circuit within the ignition box. The output of the interface box ties into the white wire trigger of any MSD ignition which bypasses the compensation circuit completely. The result is that the ignition timing remains rock steady throughout the entire operating range of the engine.

## **STACKED TRIGGER PICKUPS**

Most dual pickup distributors position the pickups 180° apart. On a distributor that has been set up with a custom timing per cylinder, when the secondary ignition is activated, the #1 cylinder now becomes the #6 cylinder (Chevy order). All of the other cylinders are shifted 180° (distributor degrees) which would affect the custom timing per cylinder. The Zero-Cross incorporates a stacked trigger design. This retains the exact firing order configuration and with the adjustable secondary pickup, can be set precisely.

### **TECH INFO: THE EFFECTS OF COIL RISE TIME ON IGNITION TIMING**

In the search for consistent ignition timing the effects of the ignition coil rise time must be taken into consideration. “Rise time” is the amount of time it takes for the coil to reach its full voltage potential. This is a function of both the ignition box and coil being used and it is measured in microseconds. The chart in Figure 14 shows the output of two different ignition coils.

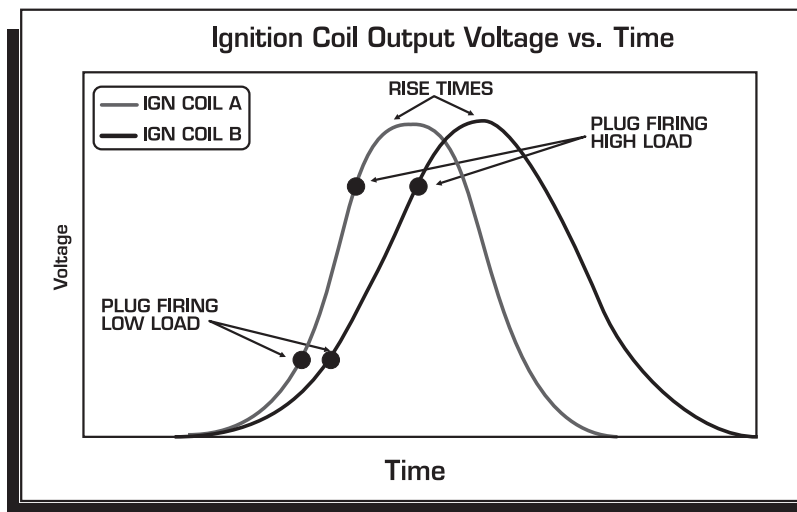


Figure 14 Coil Rise Time.

Notice that the rise time is at the peak of the curve. The firing of the spark plug is shown on the rising edge of the curves and varies with cylinder pressure among other variables. During low cylinder pressure conditions (idling and part throttle operation) the voltage required to jump the plug gap is minimal corresponding to the low load points on the graph. During high cylinder pressure conditions (full throttle operation) the voltage required to jump the plug gap is the greatest and corresponds to the high load points on the graph. This explains that time delay to ignition firing is dependent on the coil rise time and cylinder pressure, not engine rpm.

The fact that the time delay to ignition firing does not change with RPM introduces some inherent timing retard into the system. The following Figures show timing retard (in crankshaft degrees) as a function of engine rpm. Note that each chart shows a different Ignition and Coil combination. These graphs show that ignition timing retards as engine rpm and engine load are increased. This retard will always be present in any ignition system and needs to be taken into consideration when setting the timing.

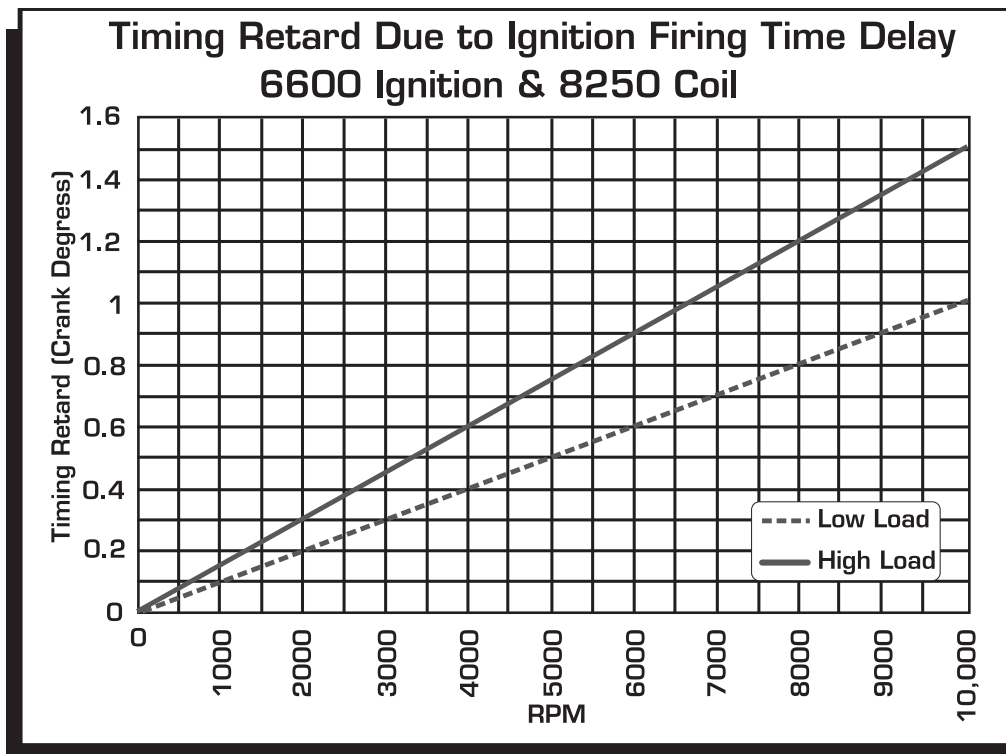
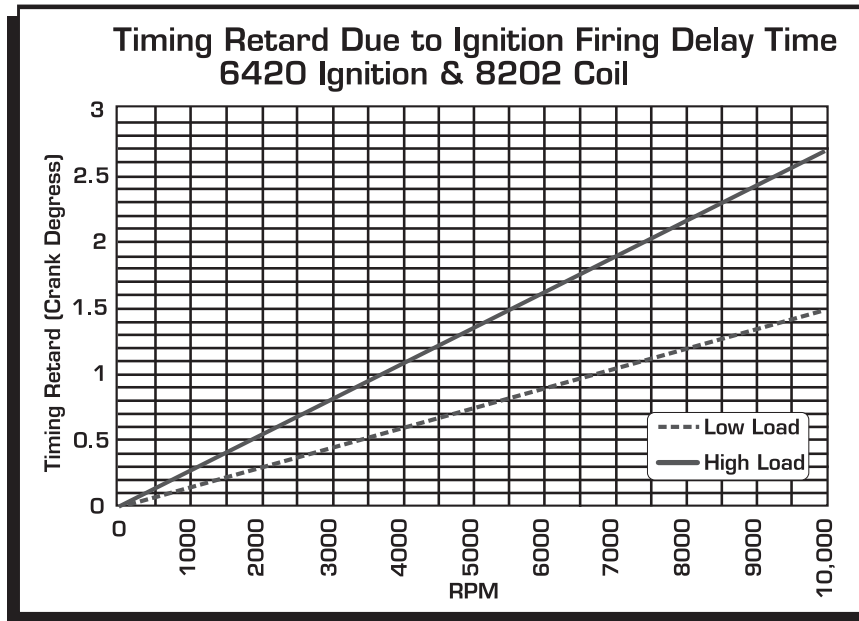
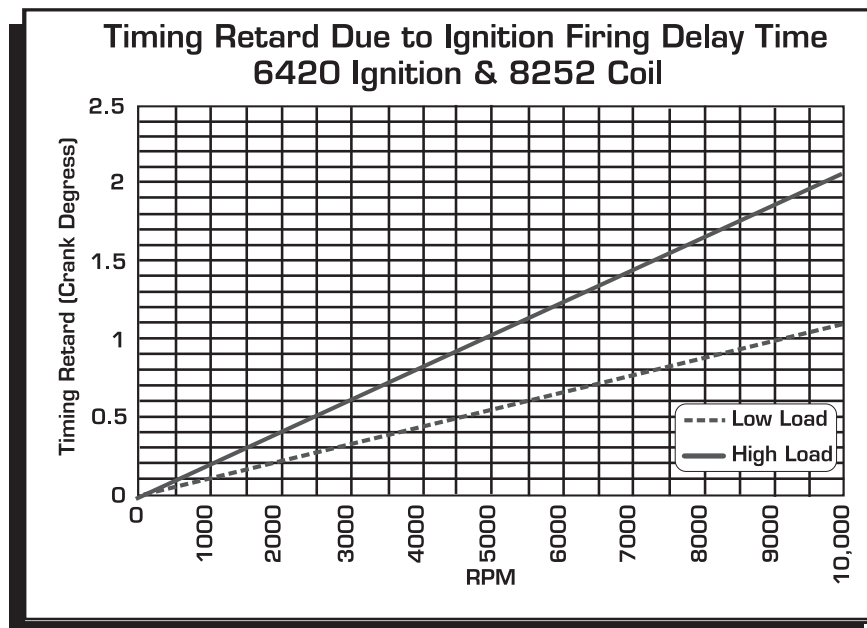


Figure 15 Coil Rise Time with MSD 6HVC System.

In Figure 14 for example, assume the engine timing is set at 1000 rpm. Looking at the low load line the timing has been retarded 0.1°. Now follow the high load line to an rpm of interest, we'll assume 8,000 rpm. At this point the retard amount is 1.2°, therefore, the amount of retard relative to the base timing at idle is 1.1° (1.2° - 0.1°). To compensate for the retard the engine will have to either be timed at the desired operating rpm or the timing at idle increased accordingly (in this case +1.1°). For comparison purposes the timing retard vs rpm is shown with an MSD 6AL Ignition box in conjunction with the PN 8202 and PN 8252 coils (Figures 16, 17). The important thing to notice is that the MSD 6 HVC system has the least amount of retard versus rpm. This is due to the fast rise time of this system.



**Figure 16 Timing Retard with MSD 6AL and Blaster 2 Coil, PN 8202.**



**Figure 17 Timing Retard with MSD 6AL and Blaster HVC Coil, PN 8252.**



# INSTALLATION INSTRUCTIONS

## TECH NOTES

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### Service

In case of malfunction, this MSD component will be repaired free of charge according to the terms of the warranty. When returning MSD components for service, Proof of Purchase must be supplied for warranty verification. After the warranty period has expired, repair service is charged based on a minimum and maximum charge.

**All returns must have a Return Material Authorization (RMA) number issued to them before being returned.** To obtain an RMA number please contact MSD Customer Service at (915) 855-7123 or fax a request to (915) 857-3344. Send the unit prepaid with proof of purchase to the attention of: **MSD Ignition, Customer Service - RMA #, 12120 Esther Lama, Dock 5, El Paso, Texas 79936.**

When returning the unit for repair, leave all wires at the length in which you have them installed. Be sure to include a detailed account of any problems experienced, and what components and accessories are installed on the vehicle.

The repaired unit will be returned as soon as possible after receipt, COD for any charges. (Ground shipping is covered by warranty). All units are returned regular UPS unless otherwise noted. For more information, call the MSD Customer Service Line (915) 855-7123. MSD technicians are available from 7:00 a.m. to 6:00 p.m. Monday - Friday (mountain time).

### Limited Warranty

MSD IGNITION warrants MSD Ignition products to be free from defects in material and workmanship under normal use and if properly installed for a period of one year from date of purchase. If found to be defective as mentioned above, it will be replaced or repaired if returned prepaid along with proof of date of purchase. This shall constitute the sole remedy of the purchaser and the sole liability of MSD Ignition. To the extent permitted by law, the foregoing is exclusive and in lieu of all other warranties or representations whether expressed or implied, including any implied warranty of merchantability or fitness. In no event shall MSD Ignition be liable for special or consequential damages.