DELCO-REMY HIGH ENERGY IGNITION SYSTEM

American Motors
4-Cylinder

DESCRIPTION

The Delco-Remy High Energy Ignition System (HEI) consists of a distributor assembly which combines all ignition components into a solid-state electronic unit. The distributor housing encloses the following components: Vacuum and centrifugal advance mechanisms, electronic module, pick-up coil, pole piece (with internal teeth), timer core or trigger wheel (with external teeth), rotor, distributor shaft and a capacitor for radio noise suppression. See *Fig. 1*.

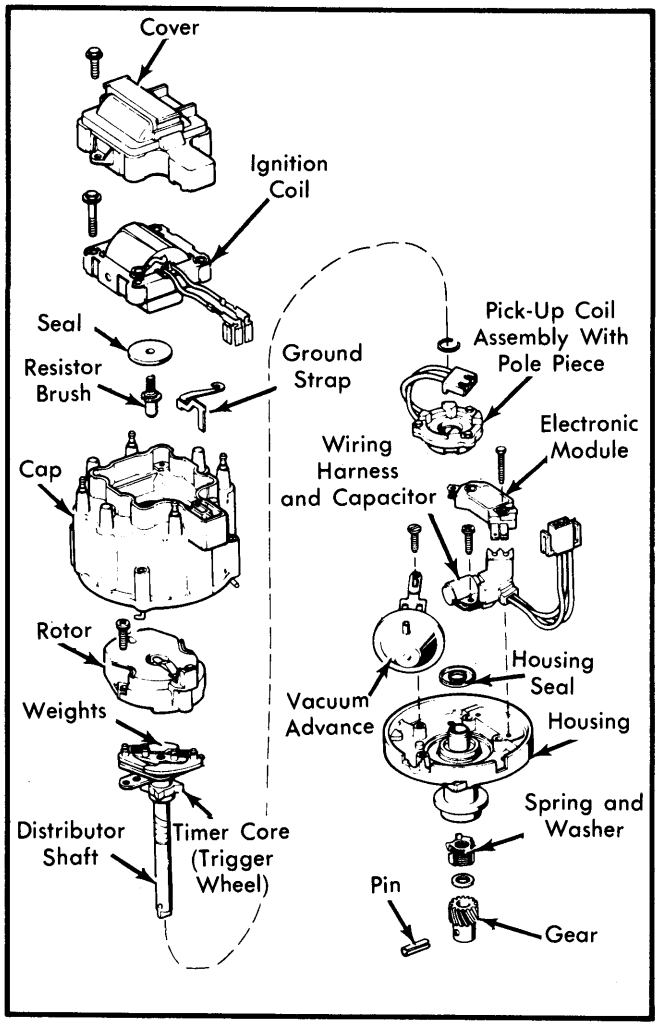

Fig. 1 Exploded View of Integral Coil Type High Energy Ignition Distributor

NOTE – *The timer core (trigger wheel) and pick-up coil (pole piece) each have 4 teeth, one for each engine cylinder.*

The distributor cover encloses the ignition coil, mounted in top of distributor cap. No ballast resistor or resistance wire is used, causing battery voltage to be applied in both "ON" and "START" ignition switch positions.

OPERATION

The pick-up coil assembly consists of a permanent magnet, a pole piece and a pick-up coil. The pick-up coil assembly is stationary, unless it is advanced or retarded by the vacuum diaphragm.

The timer core, mounted on the distributor shaft, rotates with the shaft inside the pole piece portion of the pick-up coil assembly. When the external teeth of the timer core line up with the internal teeth of the pole piece, a voltage is induced in the pick-up coil. This signals the electronic module inside the distributor, which opens the ignition coil primary circuit. See *Fig. 2*.

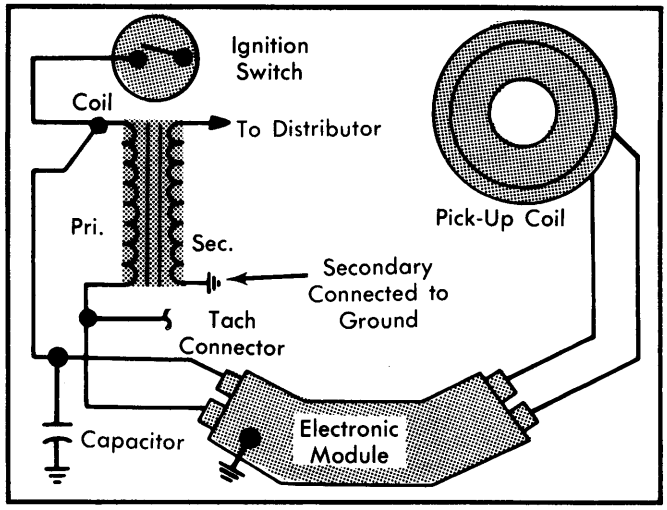

Fig. 2 Delco-Remy High Energy Ignition System Basic Wiring Diagram

Current then decreases in the primary circuit and high voltage is induced in the ignition coil's secondary circuit. This travels through the rotor, distributor cap contact and secondary wires to fire the spark plugs.

A vacuum advance unit adjusts position of pick-up coil and pole piece, providing vacuum spark advance. Conventional centrifugal advance weights shift the trigger wheel on the distributor shaft, providing centrifugal spark advance.

The electronic module automatically controls dwell period, stretching it with increasing engine speed. Dwell is not adjustable and periodic checks of dwell are unnecessary. The HEI system features a longer spark duration, which is desirable for firing lean and EGR diluted mixtures.

TESTING

NOTE – *During testing procedures, the following precautions must be observed. Do not ground tachometer terminal of distributor connector. Disconnect ignition switch connector at distributor before making compression checks. To remove spark plug wires, twist boot ½ turn and pull on boot (not on wire). When using a timing light connect at plug end of number 1 spark plug wire (do not pierce plug boot).*

Check that wiring connector is properly attached to connector at side of distributor cap and that spark plug leads are properly connected at both ends before continuing with test procedures.

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SYSTEM VOLTAGE CHECK WITH MODIFIED SPARK PLUG

1) Using spark tester or modified spark plug (side electrode cut off), check for spark at each spark plug. See *Fig. 3*. If sparks occur, check fuel system and spark plugs. If no sparks occur, connect positive voltmeter lead to distributor "BAT" terminal lead in cap and negative lead to ground.

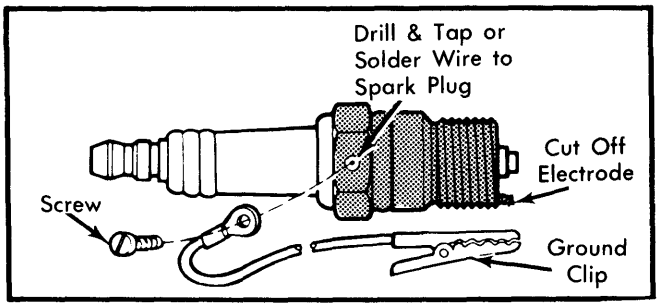

Fig. 3 Modifying Spark Plug for Testing

2) If reading is under 7 volts while cranking engine, repair primary circuit to ignition switch. If reading is 7 volts or more, connect positive voltmeter lead to "TACH" terminal of distributor cap and negative lead to ground.

3) Turn ignition switch "ON". If reading is more than 10 volts, proceed to step **6)**. If voltage reading is less than 1 volt, replace ignition coil. If 1-10 volts, replace electronic control module in distributor. Then proceed to step **4)**.

4) Remove pick-up coil connector (green and white wires) from electronic control module. See *Fig. 4*. Attach modified spark plug to coil secondary terminal (inside distributor cap). Attach positive lead of voltmeter to "TACH" terminal of distributor cap and negative lead to ground. Watch voltmeter as test lamp is connected from battery power to module's "G" (small) terminal for about 5 seconds. Remove test lamp from terminal "G" of module, checking for spark at modified plug.

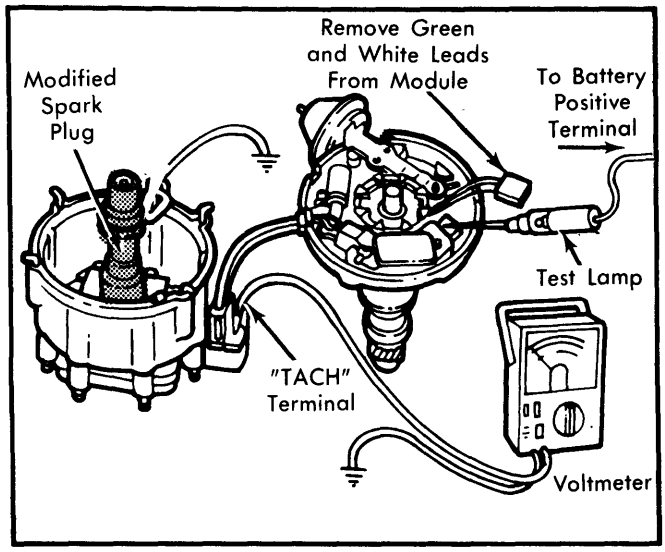

Fig. 4 Checking Ignition Coil for Defects

5) If plug sparks, system is OK. If not, replace ignition coil, as it is defective.

6) If in step **3)**, the reading was more than 10 volts, attach modified spark plug again to coil secondary terminal (inside distributor cap). See *Fig. 5*. Leave harness connected between distributor and cap. Crank engine and check for sparks at modified plug. If sparks occur, inspect distributor cap for water, cracks or other damage. If OK, replace rotor.

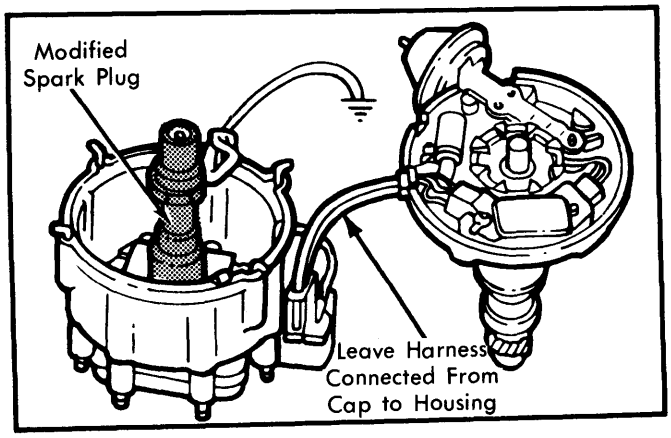

Fig. 5 Checking Distributor Components

7) If in step **6)**, no sparks occurred, remove pick-up coil leads from control module. Turn ignition switch "ON". Connect positive voltmeter lead to distributor "TACH" terminal and negative lead to ground. Watch voltmeter as test lamp is connected from battery power to module's "G" (small) terminal for 5 seconds.

8) If voltage does not drop, check module ground connection. Also check for open wires from cap to distributor. If OK, replace control module. If in step **7)**, voltage dropped, check for spark at modified spark plug WHEN test lamp is REMOVED from module's "G" terminal. If spark occurs, replace pick-up coil.

9) If no spark occurred when lamp was removed, check module with tester. If bad, replace control module. If OK, check ignition coil ground. If ground is OK, replace ignition coil.

10) If no module tester is available, check ignition coil ground. If OK, replace ignition coil. Then, again attach voltmeter positive lead to "TACH" terminal and negative lead to ground. Connect modified spark plug to coil secondary terminal (inside distributor cap). See *Fig. 4*. Connect test lamp between battery power and module "G" (small) terminal. Remove test lamp and spark should occur at gap of modified spark plug.

11) If so, system is OK. If no spark occurs, reinstall original ignition coil and replace control module.

INTERMITTENT PROBLEMS

1) Attach modified spark plug, in turn, to 2 different spark plug wires and crank engine. If no spark, repeat previous test, System Voltage Check with Modifed Spark Plug.

2) If spark occurs from one or both wires, check pick-up coil resistance for 500-1500 ohms. If not to specifications, replace pick-up coil. If OK, check for dwell increase from a high to low RPM.

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3) If dwell increases, check fuel system, spark plug wires, distributor cap and spark plugs. If no increase occurs, replace electronic control module.

ENGINE STARTS BUT RUNS ROUGH

Check for proper fuel delivery to carburetor, vacuum hoses for leakage, ignition timing, centrifugal advance for proper operation, spark plugs for defects, and visually inspect and listen for sparks jumping to ground or to other wires. If no defects are found or condition continues after correction, follow procedures under Component Testing.

COMPONENT TESTING

Distributor Cap & Coil Testing – **1)** Remove distributor cap and coil assembly by removing wiring harness connector, battery feed and tachometer lead and then turning cap-to-housing latches. Inspect rotor, cap and coil assembly for arc-over. Replace parts as required.

2) To test coil primary resistance, connect 1 ohmmeter lead to "BAT" terminal on distributor cap and other lead to "TACH" terminal on cap. *See "A" in Fig. 6.* Ohmmeter reading should be 0.4-1.0 ohm. If not to specifications, replace ignition coil.

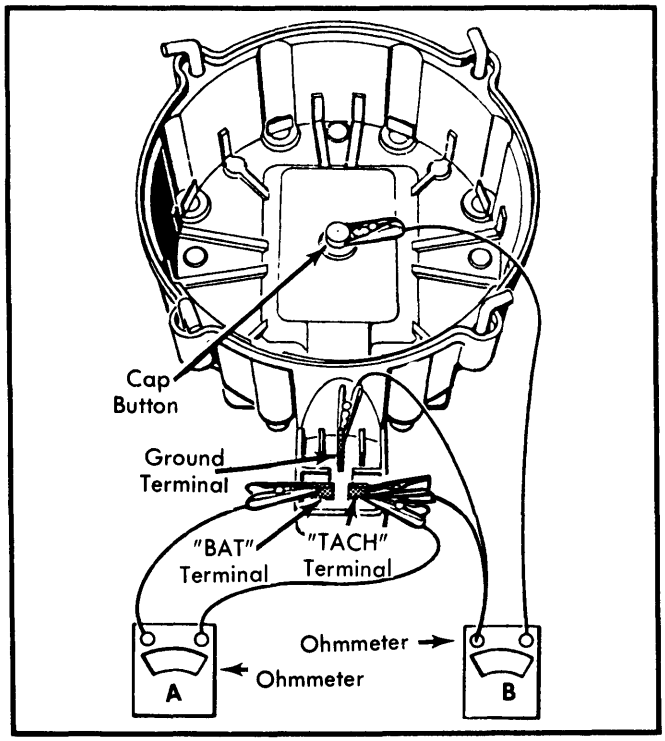

Fig. 6 Distributor Cap and Coil Testing Connections for Delco-Remy HEI Distributor

3) To test coil secondary resistance, connect 1 ohmmeter lead to coil secondary contact (center button inside cap) and other lead to "TACH" terminal. *See "B" in Fig. 6.* Ohmmeter reading should be infinity.

4) Move ohmmeter lead from "TACH" terminal and attach to ground terminal in cap. Ohmmeter reading should be 6,000-30,000 ohms. If tests are not to specification, replace ignition coil.

Pick-Up Coil – **1)** Connect test stand vacuum source to vacuum advance unit. If vacuum unit is inoperative, replace unit. Remove pick-up coil connector (green and white wires) from module. Connect ohmmeter leads to either pick-up coil lead and to distributor housing. *See "A" in Fig. 7.* Set ohmmeter on middle scale. Operate vacuum advance through range. Reading should be infinite at all times. If not, replace pick-up coil.

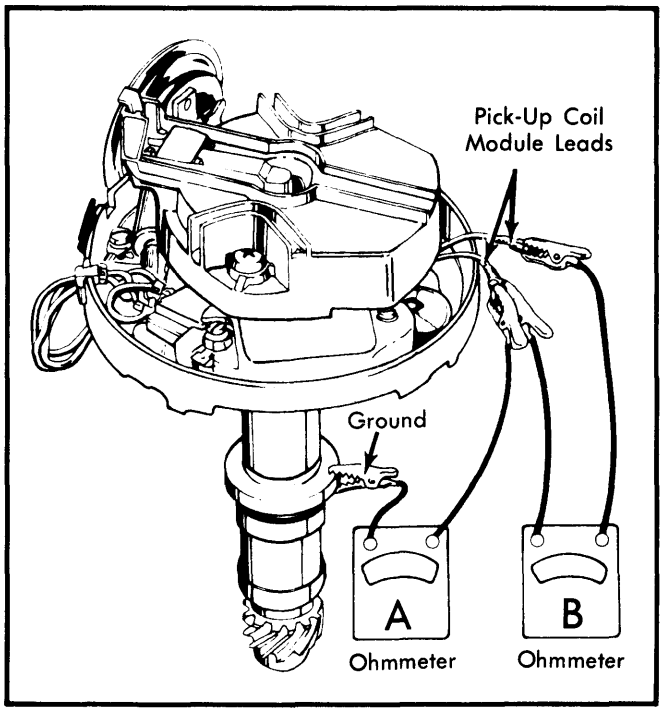

Fig. 7 Distributor Pick-Up Coil Testing Connections

2) Connect ohmmeter leads to pick-up coil leads (green and white wires shown in "B" of *Fig. 7.*). Again use middle scale. Operate vacuum through range. Ohmmeter should read 500-1500 ohms in all advance positions. If readings are not as specified, replace pick-up coil.

Capacitor – Set ohmmeter in x1000 scale. Disconnect capacitor. Touch ohmmeter leads to capacitor terminal and to ground. The needle should move slightly (but very quickly) and return to infinity. Any continuous reading other than infinity indicates defective capacitor.

Electronic Module – If engine operation remains rough after preceding test procedures are completed, replace the electronic module.

OVERHAUL

DISASSEMBLY

1) Disconnect wiring harness from distributor cap. Disconnect coil connectors from cap. Remove distributor cap and disconnect vacuum hose from vacuum advance mechanism. Mark rotor position to distributor housing and distributor housing to engine for later reassembly reference. Remove hold-down bolt and remove distributor housing from engine.

2) Remove rotor, two advance springs, weight retainer and advance weights. Mark distributor shaft and gear so they may

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be assembled in same position. Drive out roll pin from drive gear while supporting gear so no damage will occur to distributor shaft. Remove gear, shim and tanged washer from distributor shaft and clean any burrs from shaft. Remove distributor shaft from housing.

NOTE – *Do not attempt to service shaft bushings in housing.*

3) Remove 2 attaching screws holding module to housing and position module so pick-up coil leads can be removed. See *Fig. 8*. Remove capacitor and wiring harness assembly. Remove "C" washer from housing and lift out pick-up coil assembly, using care to disconnect it from vacuum advance mechanism.

4) Remove 2 attaching screws and lift out vacuum advance mechanism. Remove 2 coil cover attaching screws and lift off cover. Remove 4 coil attaching screws, disconnect coil leads and remove coil from cap. Remove ignition coil arc seal.

REASSEMBLY

Reverse disassembly procedures while noting following: Ensure there is special silicone lubricant between module and distributor base to provide heat transfer for module cooling. Lubricate felt washer with a few drops of engine oil. After installation of distributor shaft, rotate to check for even clearance between external timer core teeth and internal pole piece teeth. Slot of rotor must fit over square lug on centrifugal advance weight base.

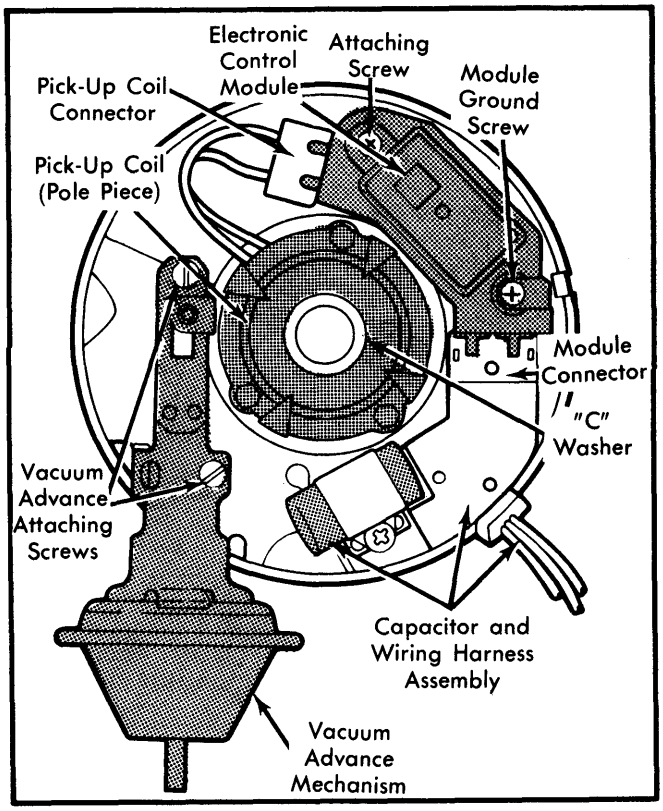


Fig. 8 Internal Components of HEI Distributor

TYPICAL DELCO-REMY HIGH ENERGY IGNITION OSCILLOSCOPE PATTERNS

PRIMARY PATTERNS (TYPICAL)

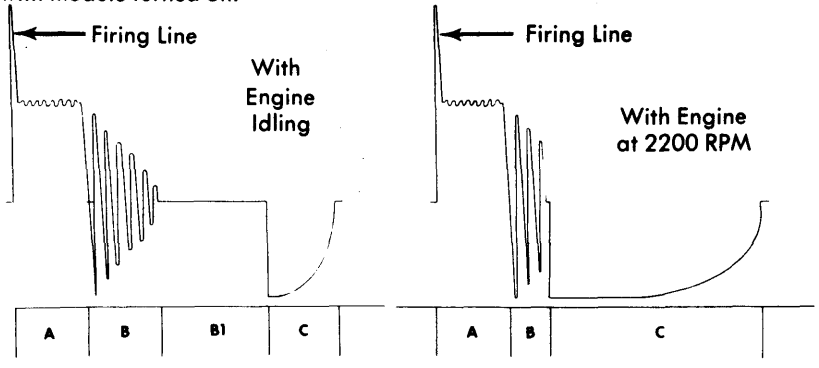
Scope Instructions for Primary Parade Only:

NOTE – *Also refer to scope manufacturers' instructions.*

1) Scope secondary pick-up cannot be connected because coil center terminal is inside distributor.
2) Connect pick-up to No. 1 spark plug wire as usual.
3) Connect primary pick-up to "Tach" terminal at distributor connector plug.

Reading Scope Primary Pattern

A) Spark Zone – spark plug arcing.
B) Coil and Condenser Zone
B1) Firing Zone – no plug arc.
C) Dwell Zone – displays current through coil primary with module turned on.



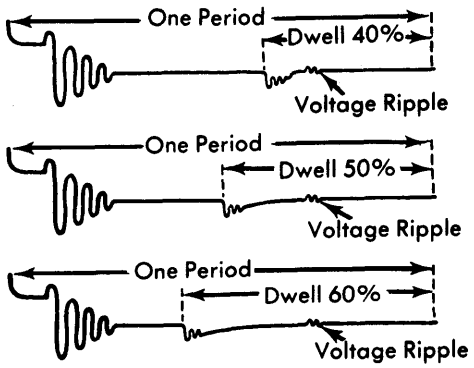
Primary Parade Pattern for One Cylinder Only

SECONDARY PATTERNS (TYPICAL)

NOTE – *A special adapter placed on top of the coil-cap assembly may be used with some scopes to view the secondary pattern. The output voltage will read low with the adapter; this is normal. Refer to the scope manufacturers' instructions.*

Secondary Voltage Patterns:

It is normal if dwell time varies from cylinder to cylinder. A 40 to 60 percent variation is shown below. It could be more, or it could be less. The voltage ripple shown may or may not appear; either is normal. Variation in dwell time or voltage ripple, as shown, does not necessarily indicate a bad module.



Typical Secondary Scope Patterns. See Scope Instructions for Actual Patterns