Distributors & Ignition Systems

DELCO-REMY HIGH ENERGY IGNITION (HEI)

Chevrolet & GMC, Except Calif. S10 Pickups with V6 Engines
Jeep Models with 4-Cylinder Engines

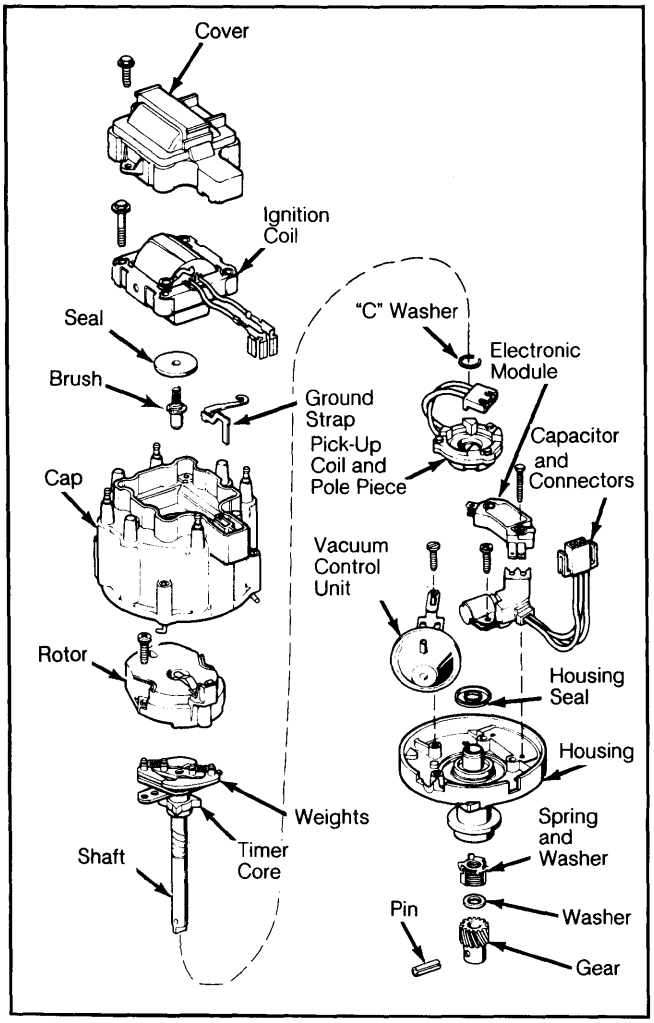
DESCRIPTION

NOTE: Some Chevrolet and GMC light truck models with 5.0L 4-Bbl. (VIN H) engines are equipped with Electronic Spark Control to combat detonation. ESC models have 5-terminal electronic modules in the distributor, while non-ESC models have 4-terminal modules.

The Delco-Remy High Energy Ignition system consists of a battery, ignition switch, ignition coil, spark plugs, primary and secondary wiring, and a special distributor assembly.

The distributor housing and cap contain vacuum and centrifugal advance mechanisms, an electronic control module, pick-up coil, pole piece (with internal teeth), timer core (with external teeth), rotor, distributor shaft and a capacitor for radio noise suppression. Some distributor models also include an integral ignition coil.

Fig. 1: Exploded View of HEI Distributor



The timer core and pick-up coil pole piece have one tooth per cylinder.

Full battery voltage is present at the battery terminal of the distributor in either the "START" or "RUN" position, as no ballast resistance wire is used.

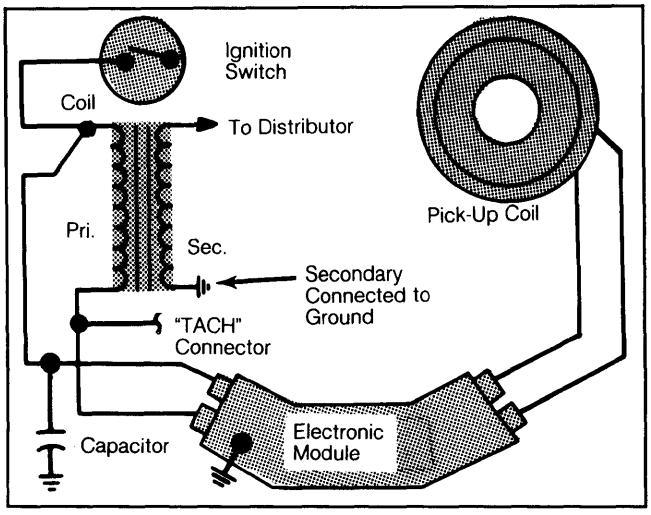
OPERATION

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 shifted by the vacuum control unit. The timer core position can also be shifted by the centrifugal weights.

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 HEI System Wiring Diagram



Module terminal letters may vary by model.

The magnetic field in the ignition coil primary circuit collapses, inducing high voltage in the coil's secondary circuit. This travels through the distributor cap contact, rotor and secondary wires to fire the spark plugs.

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

CAUTION: 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.

NOTE: 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).

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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.

ENGINE WILL NOT START

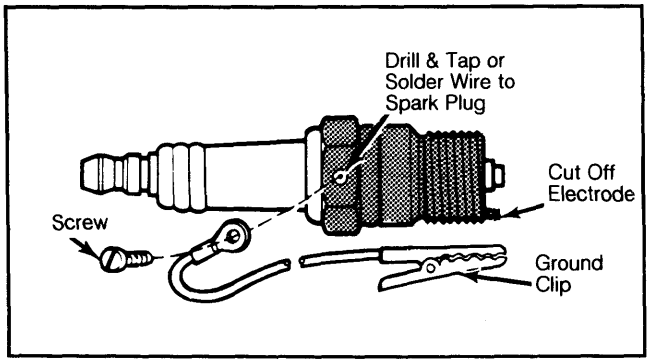
NOTE: If engine is difficult to start or misses, check position of battery terminal connector at distributor cap. Terminal must be inserted on side of connector opposite hold-down clip.

1) Connect voltmeter between battery terminal lead on distributor connector and ground. Turn ignition switch on. If voltage is zero, check system for open circuit.

2) If reading is battery voltage, connect a modified spark plug (plug that has ground electrode cut off) to center brush contact in distributor cap.

3) Crank engine. If spark occurs, trouble is not in ignition system. Check fuel system, spark plugs and wires for trouble. If sparking does not occur, follow procedures under *System Testing or Component Testing. See Fig. 3.*

Fig. 3: Modifying Spark Plug for Testing



A commercial spark tester may also be used.

ENGINE STARTS BUT RUNS ROUGH

1) 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.

2) If no defects are found or condition continues after correction, follow procedures under *System Testing or Component Testing.*

SYSTEM TESTING

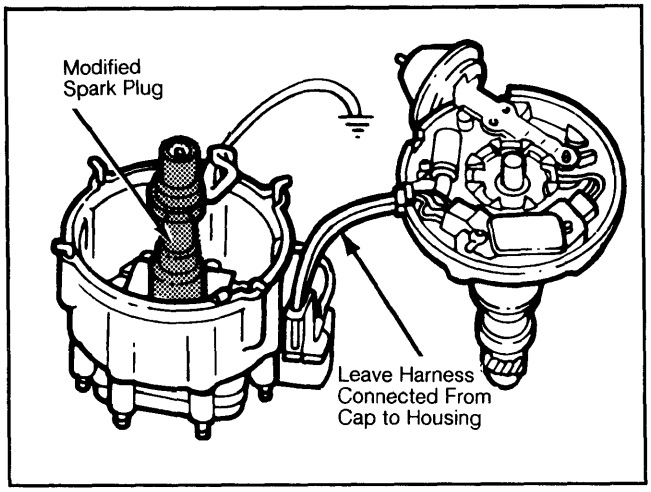
1) Connect voltmeter positive lead to distributor battery terminal and negative lead to ground. Crank engine. If voltage is under 7 volts, repair or replace wiring or components back to battery, including ignition switch and all connections.

2) If voltmeter reading in step **1)** was 7 volts or more, connect positive lead of voltmeter to "TACH" terminal of distributor, while leaving negative lead attached to ground. If voltmeter reading is 10 volts or more, proceed to step **4)**.

3) If reading in step **2)** was under 1 volt, replace ignition coil. If reading was 1-10 volts, replace electronic HEI module in distributor, and check for spark as instructed in step **9)**. If spark results, system is OK. If no spark results, replace ignition coil in addition to the module.

4) If reading in step **2)** was 10 volts or more, remove distributor cap, but leave wiring harness attached to cap connector. Connect spark tester (ST-125) or modified spark plug so terminal touches center contact of cap. Ground tester ground wire, and crank engine. *See Fig. 4.*

Fig. 4: Checking for Spark at Ignition Coil Output Terminal

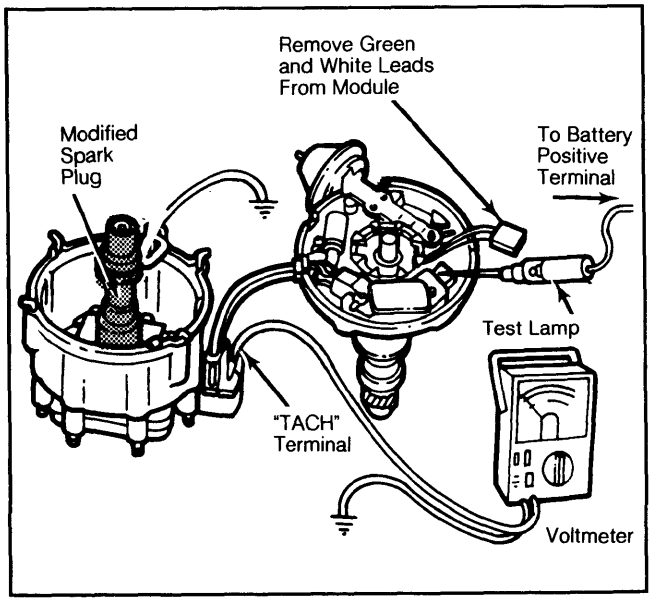


Integral coil model is illustrated.

5) If spark occurs, inspect cap for water, cracks, or other defects. If cap is OK, replace rotor. If no spark occurred in step **4)**, remove pick-up coil leads (Green and White wires) from module. Again, check voltage at "TACH" terminal of distributor cap.

6) Attach voltmeter positive lead to "TACH" terminal and negative lead to ground. *See Fig. 5.* Turn ignition switch on. Attach test light to battery positive terminal.

Fig. 5: Checking Distributor Components with Voltmeter and Test Light



Integral coil model is illustrated.

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7) Observe voltmeter reading as you momentarily (no more than 5 seconds) touch other test light lead to module terminal "P" (small terminal) on Jeep models and Chevrolet and GMC Federal S10 pickups. Touch test light to module "G" terminal on other Chevrolet and GMC models.

8) If voltage did not drop, check module ground. Also check for open in wires for distributor to cap. If OK, replace HEI module.

9) If voltage dropped in step **5)** when test light was connected, or if 1-10 volts was recorded in step **2)**, check for spark at coil center contact (using spark tester as before) as test light is removed from module's "G" or "P" terminal.

10) If spark results, replace pick-up coil assembly. If no spark appears, use module tester to test HEI module. If OK, check ignition coil ground. If ground is OK, replace ignition coil. If module is defective, replace it.

11) If no module tester is available, check ignition coil ground circuit. If OK, replace ignition coil and repeat step **9)**. If spark results, system is OK. If no spark results, original coil is OK. Replace module.

INTERMITTENT SYSTEM PROBLEMS

1) Using a spark tester or modified spark plug, check for spark at 2 spark plug wires. If no spark results, *see System Testing*. If spark is noted on one or both wires, check for dwell increase from low to high RPM.

2) Check pick-up coil with ohmmeter leads attached to Green and White wires, removed from HEI module. If reading does not indicate between 500-1500 ohms, replace pick-up coil. If pick-up coil reading was satisfactory, and dwell did not increase, replace electronic module.

3) If pick-up coil was satisfactory, but dwell increased, check fuel, spark plug wires, distributor cap, rotor or spark plugs.

COMPONENT TESTING

Distributor Cap & Coil Testing

1) Remove distributor cap and coil assembly by removing wiring harness connector, battery lead, and cap-to-housing latches. Inspect rotor, cap, and coil assembly for arc-over. Replace parts as necessary.

2) To test coil primary resistance on **integral** ignition coil, connect ohmmeter leads to battery and "TACH" terminals on distributor cap. *See Fig. 6.* Ohmmeter reading should be zero or nearly zero. Replace coil if not to specifications.

3) Connect ohmmeter leads to "TACH" terminal and ground, and note reading. Next, test coil secondary resistance by connecting ohmmeter leads to coil secondary contact (cap button) and "TACH" terminal. *See Fig. 6.* Replace coil only if both readings are infinity.

4) On **external** coils, connect ohmmeter leads to battery and "TACH" terminals. *See Fig. 7.* Primary resistance should read zero or nearly zero.

5) Now connect leads to battery terminal and ground. On high scale, an infinity reading should be indicated. For secondary coil resistance, connect ohmmeter leads to "TACH" and secondary terminals. Ohmmeter should read less than infinite.

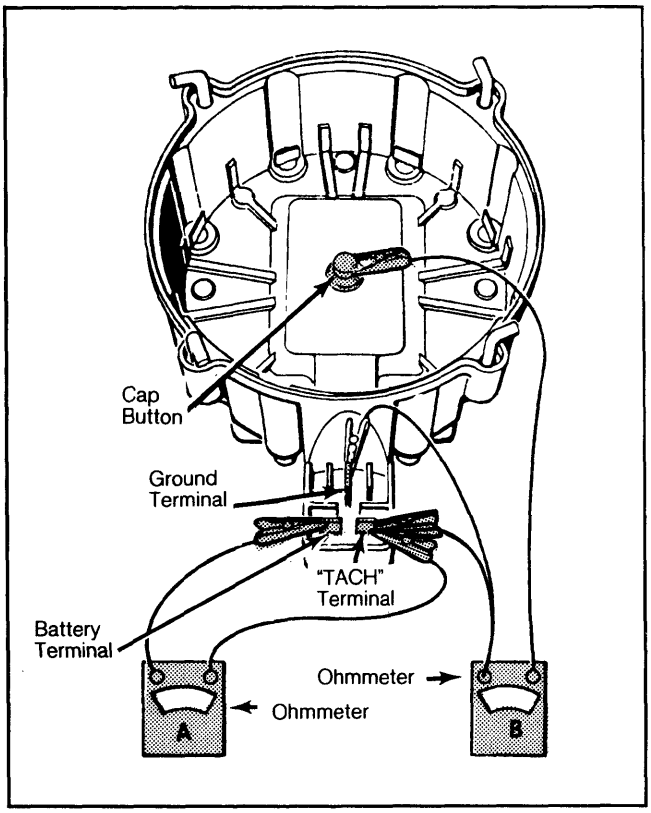
Distributor Pick-Up Coil

1) Connect external vacuum source to vacuum advance unit. If vacuum advance unit is inoperative, replace unit. To check pick-up coil for shorts, connect ohmmeter leads as *shown by meter "A" in Fig. 8.*

2) Set on middle scale of meter. Operate vacuum advance through range. Reading should be infinite at all times. If not, replace pick-up coil.

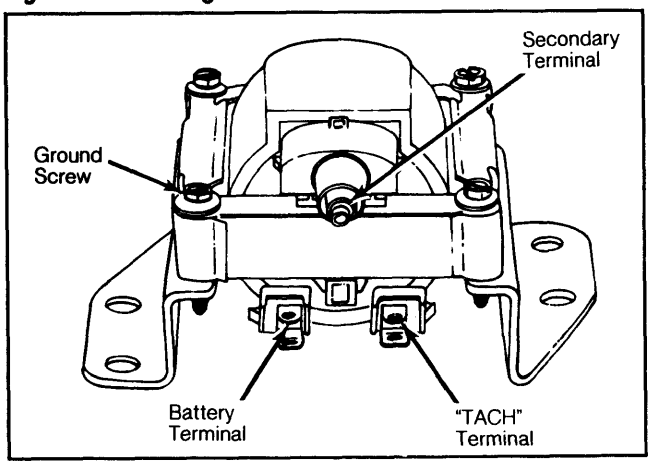
3) To check pick-up coil resistance, connect ohmmeter leads as *shown by meter "B" in Fig. 8.* Again use the middle scale. Operate vacuum advance through its range. Ohmmeter reading should be 500-1500 ohms in all advance positions. If readings are not as specified, replace pick-up coil.

Fig. 6: HEI Distributor Cap and Coil Testing Connections with Integral Coil



Be sure leads contact proper connections.

Fig. 7: Coil Testing Connections with External Coil



Touch coil mounting screw for ground.

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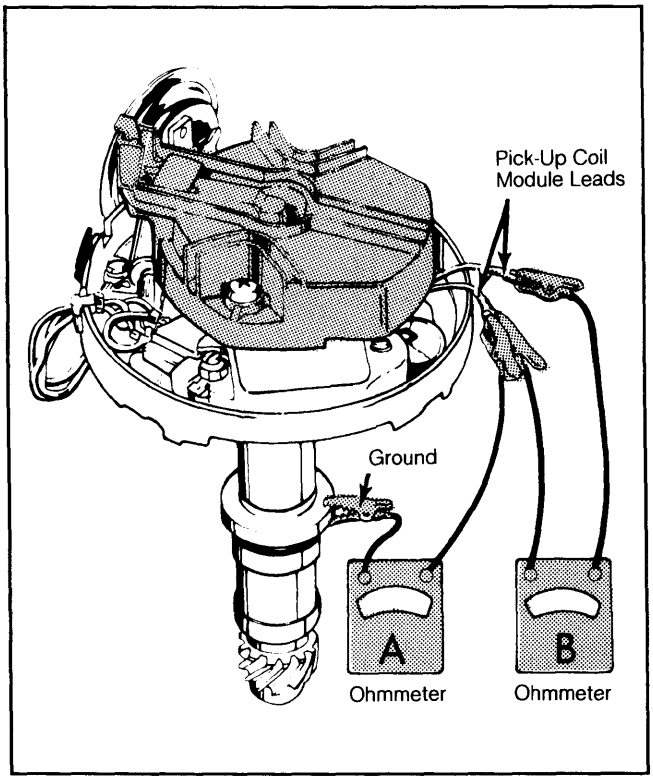
Fig. 8: Distributor Pick-Up Coil Testing Connections



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.

HEI Distributor Electronic Module

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

NOTE: When installing a new HEI module, use silicone lubricant on back of module and on housing under module.

ELECTRONIC SPARK CONTROL (ESC) TESTING

NOTE: Electronic Spark Control (ESC) is used on some Chevrolet and GMC models using the 5.0L 4-Bbl. (VIN H) engine.

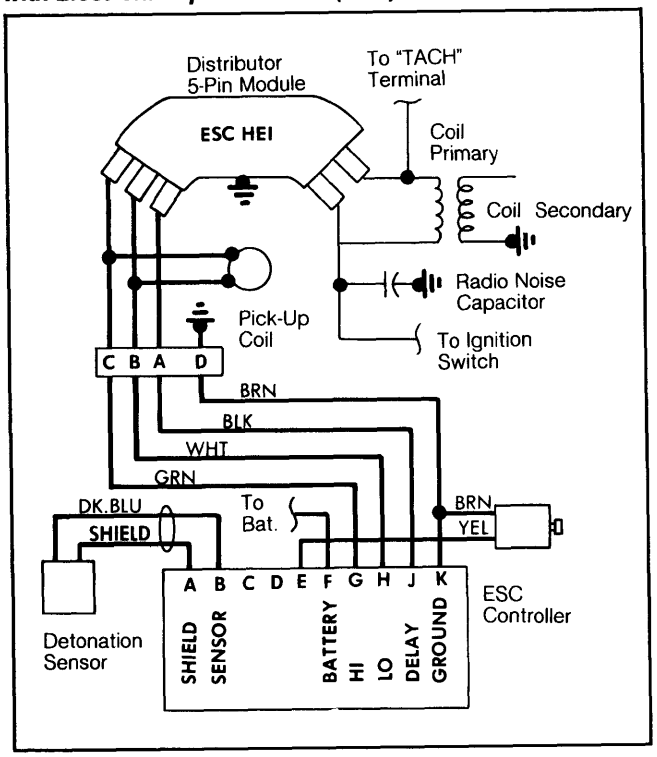
Detonation Problems

1) With engine running at fast idle speed and transmission in Neutral or Park, tap exhaust manifold lightly and repeatedly. Check for spark timing retard with a timing light. If retard is noted, check other engine detonation causes.

2) If no retard occurs, disconnect 10-pin connector from ESC controller in passenger compartment. Connect ohmmeter leads between pins "B" and "K" of connector. Resistance should be 175-375 ohms. If so, proceed to step **4)**.

3) If resistance reading was either high or low, disconnect detonation sensor wire. Measure resistance by connecting ohmmeter leads to sensor terminal and ground. Reading should be 175-375 ohms.

Fig. 9: Wiring Diagram for HEI System with Electronic Spark Control (ESC)



4) If high or low, replace sensor. If OK, check wires from pins "A", "B", and "K" of 10-pin connector for opens or shorts. If OK, repair sensor connector. If not OK, replace or repair wiring harness.

5) If resistance reading in step **2)** was OK, try to start engine with 10-pin connector disconnected. If it starts, replace distributor's HEI module.

6) If engine will not start, reconnect 10-pin connector to controller. Disconnect sensor wire from sensor, and insert a jumper wire into sensor wire connector. With engine running at fast idle speed, lay wire on top of distributor over ignition coil. If spark timing retard occurs, replace sensor.

7) If no spark retard occurs, connect voltmeter positive lead to pin "H" of 10-pin connector and negative lead to pin "K". With ignition switch "ON", voltage should read more than 0.2 volt. If voltage is more than 0.2 volt, replace ESC controller. If less than 0.2 volt, repair open wire from pin "H" in ESC harness.

Poor Engine Performance Problems

1) Disconnect 4-pin connector at distributor, and install a jumper wire between pins "A" and "C" of distributor connector. If problem remains, check other causes of poor engine performance.

2) If problem disappeared, remove jumper wire and reconnect 4-pin connector. Without disconnecting 10-pin ESC connector, attach jumper wire from pin "A" to pin "B". If problem remains, proceed to step **5)**.

3) If problem disappeared in step **2)**, remove jumper wire and disconnect 10-pin connector at controller. Connect ohmmeter leads to pins "B" and "K". Resistance should read 175-375 ohms. If OK, check for engine noises other than detonation that might cause input to sensor.