DELCO-REMY HEI-EST IGNITION SYSTEM

Chevrolet & GMC Calif. S10 Pickups with V6 Engines

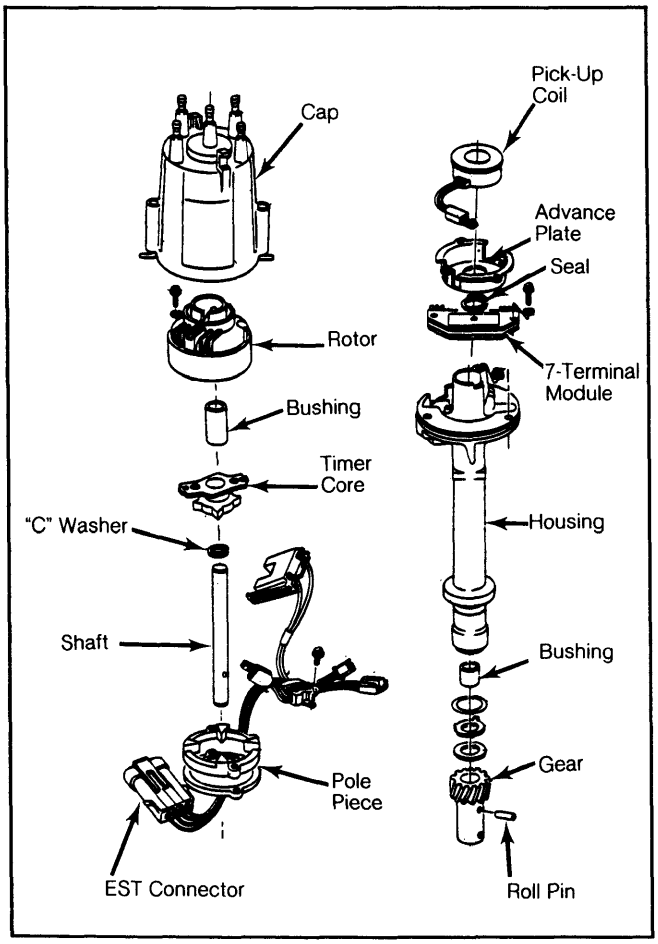
DESCRIPTION

The Delco-Remy HEI-EST system, a part of all General Motors Computor Command Control (CCC) systems, is designed to provide optimum performance through electronic control of air/fuel ratios, spark timing, air management and idle speed.

The system consists of an electronic control module (ECM), an HEI-EST distributor, an external ignition coil, and necessary wiring. The distributor has neither vacuum nor centrifugal advance mechanisms. *See Figs. 1 and 2.*

The distributor contains a 7-terminal HEI-EST electronic module, a timer core, pole piece, pick-up coil, and a radio noise suppression capacitor.

Fig. 1: Disassembled View of EST Distributor

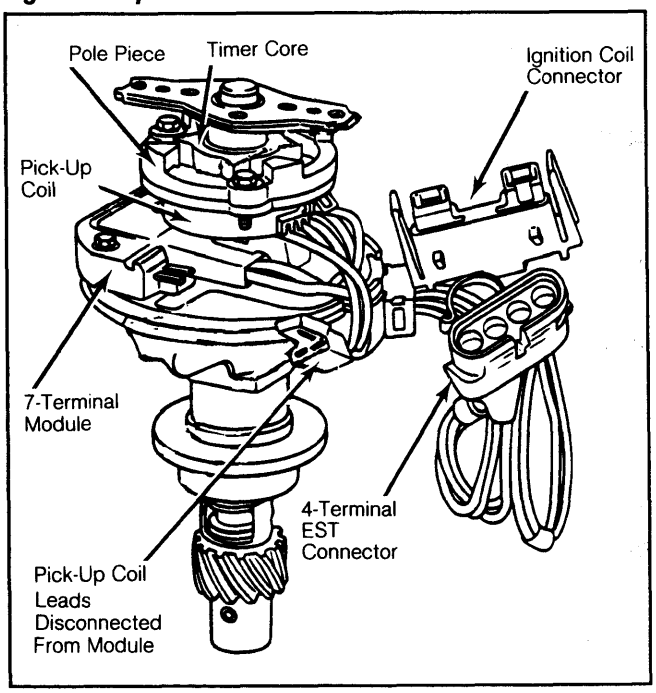


Distributor works with an external ignition coil.

The distributor is connected to the EST system by means of a 4-wire connector, leading to the CCC system's electronic control module (ECM).

The ECM (not the distributor HEI-EST module) receives voltage signals from a number of sensors. A typical system could be provided signals from oxygen, engine coolant temperature, throttle position, barometric pressure and manifold absolute pressure sensors, as well as, the distributor pick-up coil.

Fig. 2: Components of an HEI-EST Distributor



Timer core and pole piece have 4 teeth each.

CAUTION: Few components are interchangeable between HEI-EST and HEI distributors used on various engines. Be sure correct part is used, as similar appearance does not mean identical design or operation.

The HEI-EST distributor module has 7 terminals. The ignition coil battery terminal (positive) is connected to the module "+" terminal; the coil's "TACH" or negative terminal to the "C" terminal. *See Fig. 3.*

Terminals "N" and "P" are attached to the pick-up coil. HEI-EST module terminal "R" connects through the EST connector "B" to ECM terminal 10 (Distributor Reference Pulse Hi). Terminal "B" connects through terminal "C" to ECM terminal 11 (Ignition Module By-Pass).

Terminal "E" connects through connector "A" to ECM terminal 12 (EST). ECM terminal 13 (Distributor Reference Pulse Lo) connects to connector "D" and then to HEI-EST module ground.

OPERATION

During cranking or in event of EST ECM failure, a by-pass signal from ECM terminal 11 to HEI-EST module terminal "B" is either absent or low. *See Fig. 3.*

This notifies the HEI-EST module to take over control of spark advance and to ignore any EST information coming from the ECM. During this period, poor engine performance may result under some conditions, but the diagnostic "CHECK ENGINE" light will not come on.

The HEI-EST module will then convert pick-up coil RPM signals, and transmit them through the by-pass switch and terminal "C" directly to the negative "TACH" terminal of the ignition coil. These signals turn the coil primary circuit on and off, causing a surge in the secondary that fires the spark plugs.

Distributors & Ignition Systems

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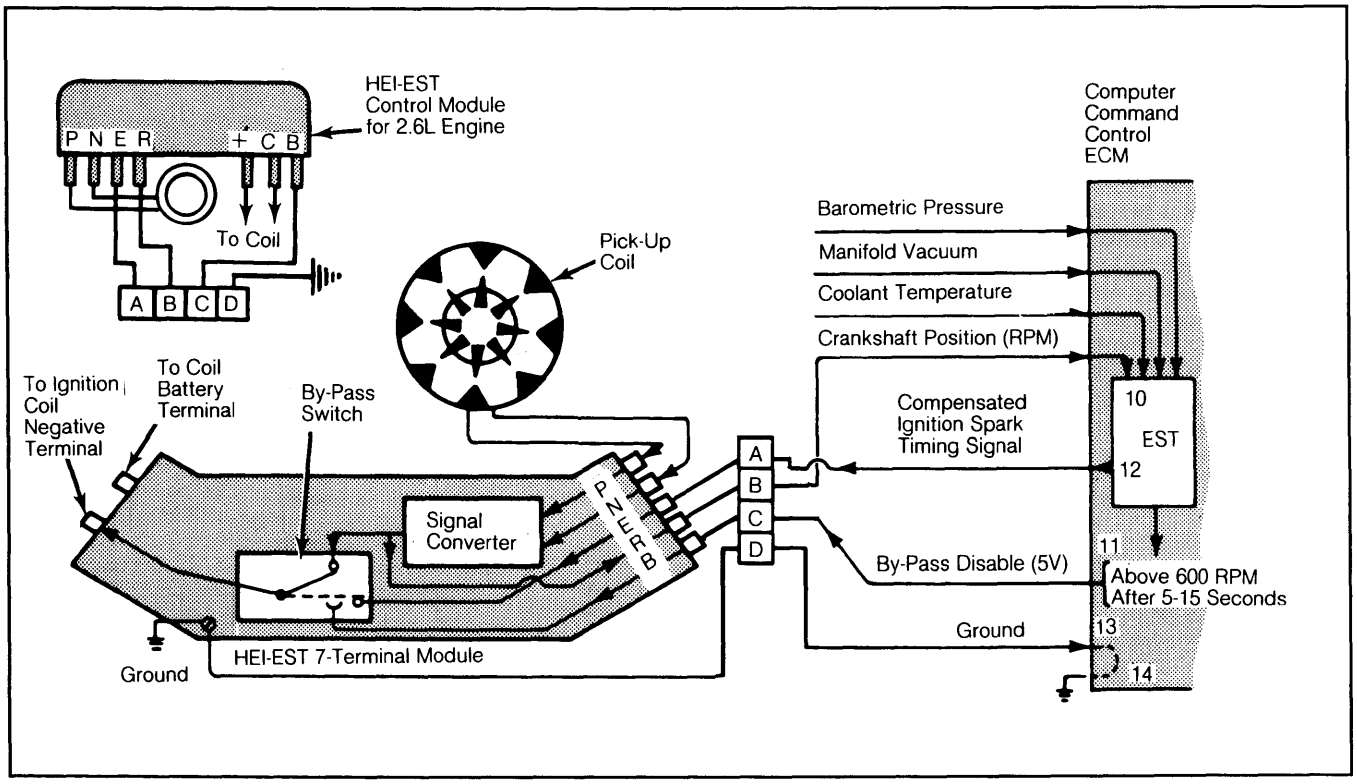
Fig. 3: Schematic of HEI-EST Ignition System, Including Relationship To Computer Command Control ECM



Upper left-hand corner of illustration shows actual shape of HEI-EST module.

When engine speed reaches 600 RPM or more (about 5-15 seconds after starting), the ECM transmits a constant 5-volt signal to the distributor HEI-EST module. This signal changes the position of the by-pass switch.

As a result, the pick-up coil's RPM signals can no longer flow directly to the ignition coil, as this circuit is now open. Instead, the signals are converted in the distributor module and routed through terminal "R" to ECM terminal 10.

The PROM (Programmed Read Only Memory) portion of the ECM carries the basic spark advance curve based on engine RPM. Spark timing is calculated by the ECM whenever an ignition pulse is present, however, spark advance information is only SENT TO the distributor when the engine is running (not during cranking).

Engine sensor values are used by the ECM to modify the PROM information, increasing or decreasing spark advance to achieve maximum performance with minimum emissions.

The coolant temperature sensor advances spark on a cold engine, and reduces advance as engine reaches normal operating temperature. If engine is too hot, spark is retarded to prevent detonation.

During light throttle operation, the throttle switch allows for additional advance. Additional adjustment by the ECM results from input from coolant temperature, engine RPM and manifold absolute pressure (MAP) sensors. When MAP is low, spark is at maximum advance.

As load increases and pressure increases, spark timing is retarded to allow the engine to maintain its performance and emission level.

After computation of all information from the various sensors, a compensated ignition spark timing signal is sent back to the distributor through the HEI-EST module's "E" terminal to the by-pass switch, "C" terminal, and ignition coil negative terminal.

Each time the signal is flashed on and off, the coil's primary circuit is turned on and off. As this occurs, a voltage surge is created in the secondary that fires the spark plugs.

The ECM is continually computing sensor information to maintain efficient engine performance with low emission levels, doing so under varying engine conditions.

PRE-TESTING DIAGNOSIS

If the reference or EST signals are interrupted due to open wires or a faulty ECM, the vehicle will still run. The HEI-EST module will provide a timing signal based on engine RPM.

If the by-pass signal is lost, the ECM cannot control spark timing, as the by-pass switch will permit direct flow of information to the ignition coil rather than to the ECM.

Normally, 5-15 seconds after starting a warm engine, the by-pass signal electronically operates a by-pass switch in the HEI-EST module. The HEI-EST module's RPM-controlled timing signal no longer can flow directly to the ignition coil, but is diverted to the ECM for modification by information from engine sensors.

Loss of the EST signal with the by-pass signal "ON", however, will stop the engine, because the HEI-EST module is no longer sending signals directly to the ignition coil, but to the ECM.

Any loss of the EST signal cuts all flow to the coil. If an attempt is made to restart the vehicle, the engine

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will run for a few seconds and then stop when the by-pass signal comes back on.

TESTING

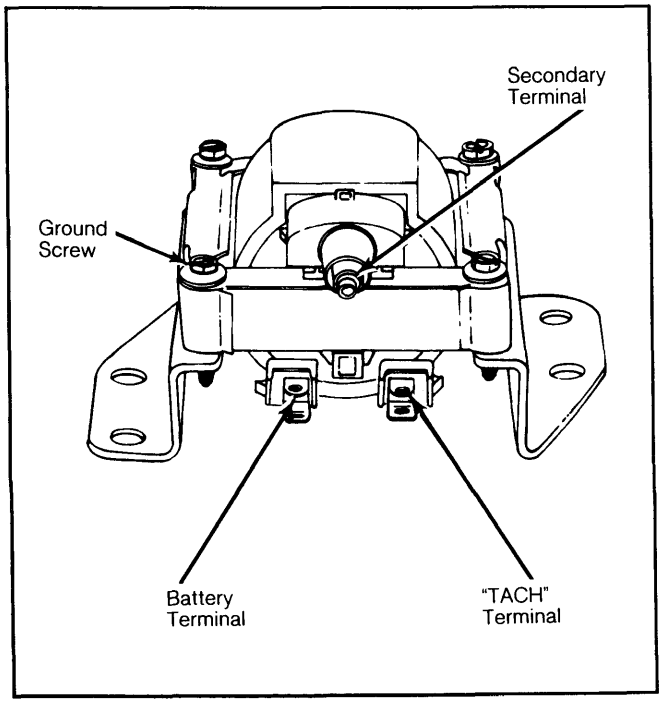
IGNITION COIL RESISTANCE CHECK

Primary Resistance

1) Remove coil connector. Using the low scale, connect ohmmeter leads to coil's battery and "TACH" terminals. *See Fig. 4.* Resistance should be zero or nearly zero. If not, replace ignition coil.

2) Set ohmmeter on high scale, and connect leads to battery terminal and a good ground on coil. Reading should be infinity. If not, replace coil.

Fig. 4: Ignition Coil Resistance Test Points



Coil primary wires must be removed for testing.

Secondary Resistance

With ohmmeter set in high range, connect leads to "TACH" terminal and to secondary terminal. Reading should be less than infinite (approximately 6,000 to 30,000 ohms). If reading is infinity, replace coil.

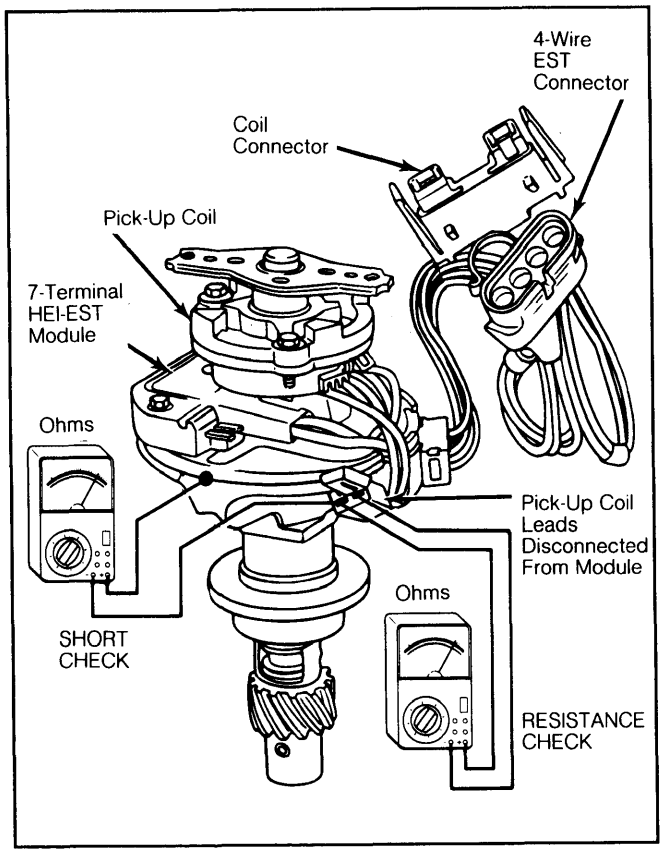
DISTRIBUTOR PICK-UP COIL SHORT AND RESISTANCE CHECKS

1) Disconnect pick-up coil leads from HEI-EST module "N" and "P" terminals (usually a Green and a White wire). To check for shorted pick-up coil, set ohmmeter in middle range.

2) Connect an ohmmeter lead to either pick-up coil wire terminal. Connect other lead to distributor housing. *See Fig. 5.* Reading should be infinite. If not, replace pick-up coil.

3) Connect ohmmeter leads to both pick-up coil leads, while flexing wires and connectors to locate intermittent opens. *See Fig. 5.* Resistance should read a constant unchanging value between 500 and 1500 ohms. If not, replace pick-up coil.

Fig. 5: Distributor Pick-Up Coil Short and Resistance Checks



Notice ohmmeter test points.

IGNITION SYSTEM CHECK

NOTE: Before making the following tests, secure an ignition spark tester. If tachometer is connected to ignition coil "TACH" terminal, disconnect it before performing tests. Use a digital voltmeter with 10 megohms impedance or larger.

1) Remove spark plug wire and attach spark tester to wire. Crank engine and check for spark at tester gap. If there is no spark, check a second wire in same manner. If sparks result, ignition system is not at fault. Suspect fuel system or spark plugs.

2) If no spark resulted in step **1)**, attach ignition tester to ignition coil secondary wire. Crank engine and recheck for spark at tester cap. If spark occurs, inspect distributor cap for water, cracks, or carbon tracking. If cap is OK, replace rotor.

3) If no spark occurred in either step **1)** or **2)**, remove distributor cap. Turn ignition system "ON". Check voltage at battery feed terminal (+) of HEI-EST module. Attach positive voltmeter lead to "+" terminal and negative lead to ground. Check for voltage while cranking engine.

4) If reading is less than 10 volts, repair primary circuit back to ignition switch. If 10 volts or more, turn ignition "ON". Move positive voltmeter lead from HEI-EST "+" terminal to module "C" terminal. Leave negative lead grounded.

5) If reading is under 1 volt, problem lies with open wire to ignition coil negative terminal, ignition coil

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connection or primary circuit of ignition coil. Repair or replace as necessary. If 10 volts or more is registered on voltmeter, proceed to step **7).**

6) If voltage reading on "C" terminal was 1-10 volts, replace distributor HEI-EST module and check for spark, following procedure outlined in steps **7) through 10).** However, if a spark results in step **10),** ignition system is OK following module replacement. If there is still no spark, replace ignition coil also, as it too is defective.

7) If in step **5),** 10 volts or more were read on module "C" terminal, remove pick-up coil connector from module. Turn ignition "ON". Check voltage again at module "C" terminal. Watch voltmeter as a test light is momentarily (not more than 5 seconds) connected to battery positive terminal to module "P" terminal.

8) If no drop in voltage occurs, check HEI-EST module ground. Also check for open in wires from distributor cap (coil) to distributor. If OK, replace HEI-EST module.

9) If voltage dropped, check for spark at tester gap (still attached to coil secondary terminal) when test light is removed from module "P" terminal. If spark occurs, either pick-up coil or its connections are defective.

NOTE: Perform Distributor Pick-Up Coil Short and Resistance Check if not done previously. Resistance should be 500-1500 ohms.

10) If no spark occurs and distributor module tester is available, check HEI-EST module. If OK, check ignition coil ground and coil-to-distributor wiring. If OK, replace ignition coil. If module is defective, replace.

11) If no module tester is available, replace HEI-EST module and repeat step **9).** If spark results, system is OK. If no spark results, original module is OK. Reinstall module and replace coil.

INTERMITTENT OPERATION CHECK

1) Connect spark tester to 2 different spark plug wires, and crank engine. If no spark, perform Ignition System Check. If spark occurs at either or both wires, check for dwell increase from low to high RPM.

2) Check pick-up coil. Replace, if faulty. If pick-up coilis good and dwell did not increase, replace HEI-EST module. If good, but dwell increased, check fuel system spark plug wires, distributor cap and plugs.

EST EMISSION SYSTEM CHECK

1) With shift lever in "PARK" (auto. trans.) or "NEUTRAL" (man. trans.), run engine at fast idle and note timing change as test terminal is grounded. If timing changes, system is operating properly. Clear memory.

2) If timing does not change on vehicles equipped with manual transmissions, proceed to step **3).** If timing does not change on vehicles equipped with automatic transmission, let engine return to idle and place transmission in "DRIVE". Note timing change as test terminal is grounded. If timing changes, system is operating properly. Clear memory.

3) If no change in timing occurs, check voltage at output of MAP (Manifold Absolute Pressure) sensor or vacuum sensor as vacuum hose is removed and re-installed. If no change occurs, problem is in the vacuum or MAP sensor circuit. If voltage output changes, proceed to next step.

4) Disconnect park/neutral switch and recheck for timing change. If timing changes, problem is either an improperly adjusted or faulty park/neutral switch. If timing does not change, check for grounded wire from terminal "H" of ECM to park/neutral switch. If wire is not grounded, replace ECM.

OVERHAUL

Disassembly

1) Remove coil connector and disconnect 4-wire EST connector. Turn 2 latches and lift off distributor cap.

2) Remove rotor and disconnect pick-up coil leads from HEI-EST module. *See Fig. 1.* Mark distributor shaft and gear for later reassembly. Drive out roll pin and remove distributor shaft from housing.

3) Remove retaining "C" washer, pick-up coil, magnet and pole piece. Remove 2 module attaching screws and capacitor screw. Lift module, capacitor and harness assembly from distributor housing. Disconnect wiring harness from module.

Reassembly

Assemble in reverse order, noting the following. Wipe distributor housing and module clean, and apply silicone grease between module and housing. Spin shaft to be sure timer core external teeth do not strike pole piece internal teeth.