

MOTORCRAFT EEC IGNITION SYSTEMS

Ford Motor Co.
Models with V8 Engines Only

DESCRIPTION

In 1980 two Electronic Engine Control (EEC) systems are used. The EEC II system is only used on a small number of Ford and Mercury models with 351" V8 engines (approximately 25,000 vehicles). The EEC III system may be used on any of the V8 models except the Versailles.

CAUTION — Different diagnostic and service procedures are required for EEC II and EEC III. To identify the EEC II vehicles, look for (1) silver engine decal rather than gold tone used for EEC III, (2) red vinyl tag near EEC module connector, marked "EEC II", (3) a paper tag on rear of calibration assembly, marked "GA" or "K" for EEC II, and (4) on EEC II vehicles, the calibration assembly does not fill out the mounting area on the processor assembly.

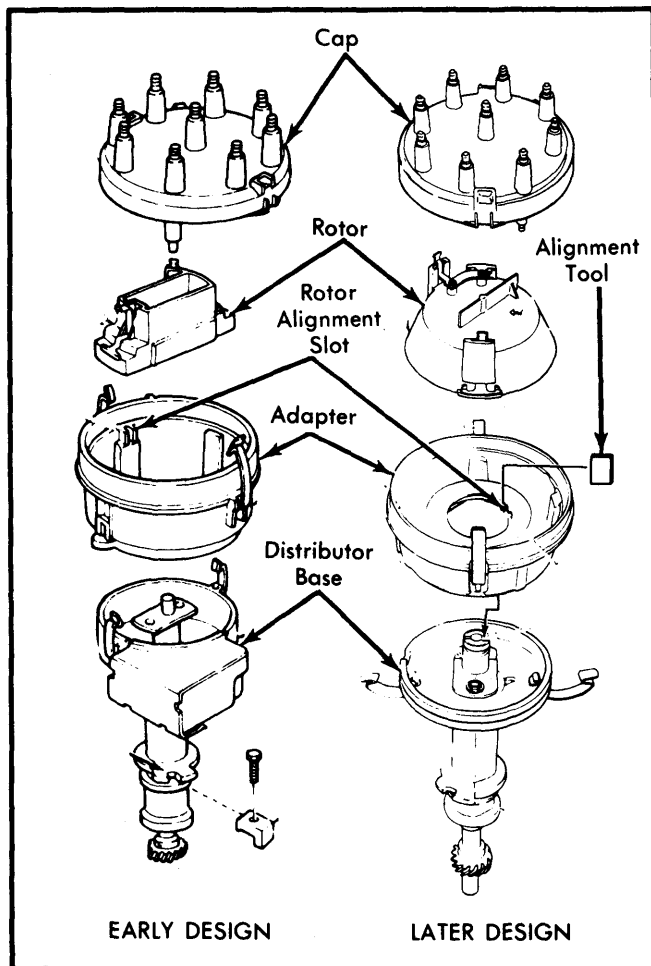


Fig. 1 EEC Distributor Components
(Early & Later Designs)

The system consists of an Electronic Control Assembly (ECA), Calibration Assembly, Dura-Spark III ignition module (Dura-Spark II ignition module is used with EEC II), 7 engine sensors, ignition coil, a special distributor (no pick-up coil, armature, or vacuum/mechanical advance systems). All engine timing is con-

trolled by the ECA, which receives information on engine and atmospheric conditions for various engine sensors. The ECA is capable of firing the spark plug at any time from TDC to 50° BTDC.

NOTE — Two different distributors are used. Some 1980 351" engines will use the early design distributor. See Figs. 1 and 9. The later design may be used on any V8 engine except Versailles models.

OPERATION

Electronic Control Assembly — The ECA is the "brain" of the EEC system. It is a solid-state, pre-programmed micro-computer, consisting of a processor assembly and a calibration assembly. The ECA is located under the instrument panel to the left of the steering column on Ford, Mercury, Continental and Mark VI models. ECA is located under the passenger seat on Mustang, Capri, Fairmont, Zephyr, Thunderbird and Cougar models.

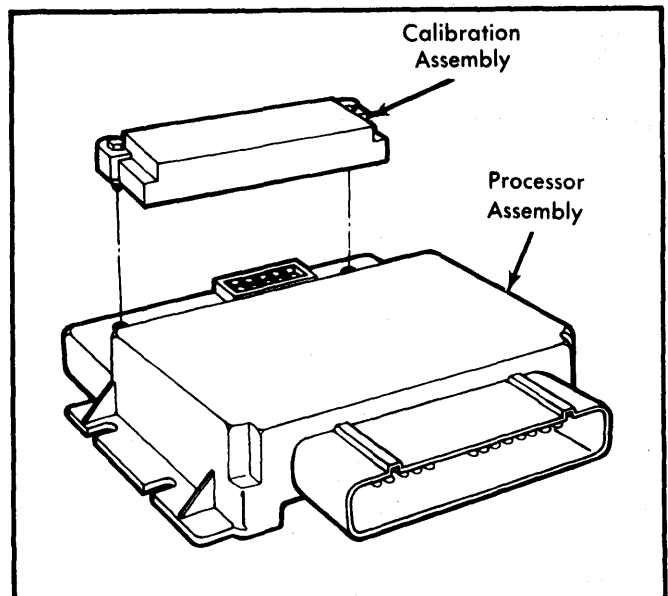


Fig. 2 EEC III Electronic Control Assembly
(EEC II Similar)

Processor Assembly — The processor assembly contains circuits designed to:

- Continuously sample the 7 engine sensor input signals for analysis.
- Convert the input signals to a form usable by the computer section in calculations.
- Choose the proper operating strategy (base engine, modulator, or limited operational) for the operating conditions.
- Perform spark, EGR, air/fuel ratio, canister purge, throttle kicker and other calculations.
- Send electrical output control signals to the ignition module and control solenoids to adjust timing and dwell, EGR flow rate, thermactor air mode, and throttle kicker mode.

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The processor assembly also provides a continuous reference voltage (about 9 volts) to the sensors.

Calibration Assembly — The calibration assembly is attached to the top of the processor assembly and contains electronic circuits in its black plastic case. It is capable of:

- Providing calibration information necessary for that particular vehicle, for use by the processor assembly.
- Provide adjustment for octane problems.

Power Relay — A power relay is attached to the lower right side of ECA mounting bracket. It supplies battery voltage to the EEC system.

Crankshaft Position Sensor — A crankshaft pulse ring with 4 lobes is pressed onto the vibration damper at the front of the crankshaft. The 4 lobes are spaced 90° apart. The EEC ring is positioned 10° BTDC on the crankshaft. As the crankshaft rotates, the pulse ring lobes pass the tip of the crankshaft position sensor. The sensor contains a permanent magnet and coil. As the lobes cut through the magnetic field of the sensor, an output voltage is generated in the coil and sent to the ECA. The ECA converts these signals to crankshaft (piston) position for spark timing and into RPM for spark advance calculation. The sensor is attached to the engine block and locked in place by a clip and screw. The sensor has no adjustment.

NOTE — A broken sensor or open wiring will prevent the ECA from receiving a position signal and prevent the engine from starting.

Barometric & Manifold Pressure Sensor — The barometric and manifold absolute pressure (MAP) sensor is actually two sensors combined in one assembly. The MAP sensor monitors the value of the intake manifold absolute pressure and atmospheric pressure. Manifold absolute pressure is defined as barometric pressure minus manifold vacuum. Barometric and manifold pressure are converted into electrical signals for use by the ECA, which will use the signals to calculate spark advance, EGR flow and air/fuel ratio. The sensor is located on the right-hand fender apron.

Coolant Temperature Sensor — The sensor converts engine coolant temperature to an electrical signal to the ECA. The ECA then controls EGR operation. Also, if the engine overheats, the ECA will advance ignition timing. The sensor is located in the heater outlet fitting at the front of the intake manifold, near the right-hand valve cover.

Throttle Position Sensor — The sensor is a variable resistor control, mounted on the carburetor throttle shaft. With a reference voltage applied by the ECA, a signal is sent to the ECA which classifies the signal into one of 3 modes:

- Closed throttle (idle or deceleration).
- Part throttle (cruise).
- Wide open throttle (maximum acceleration).

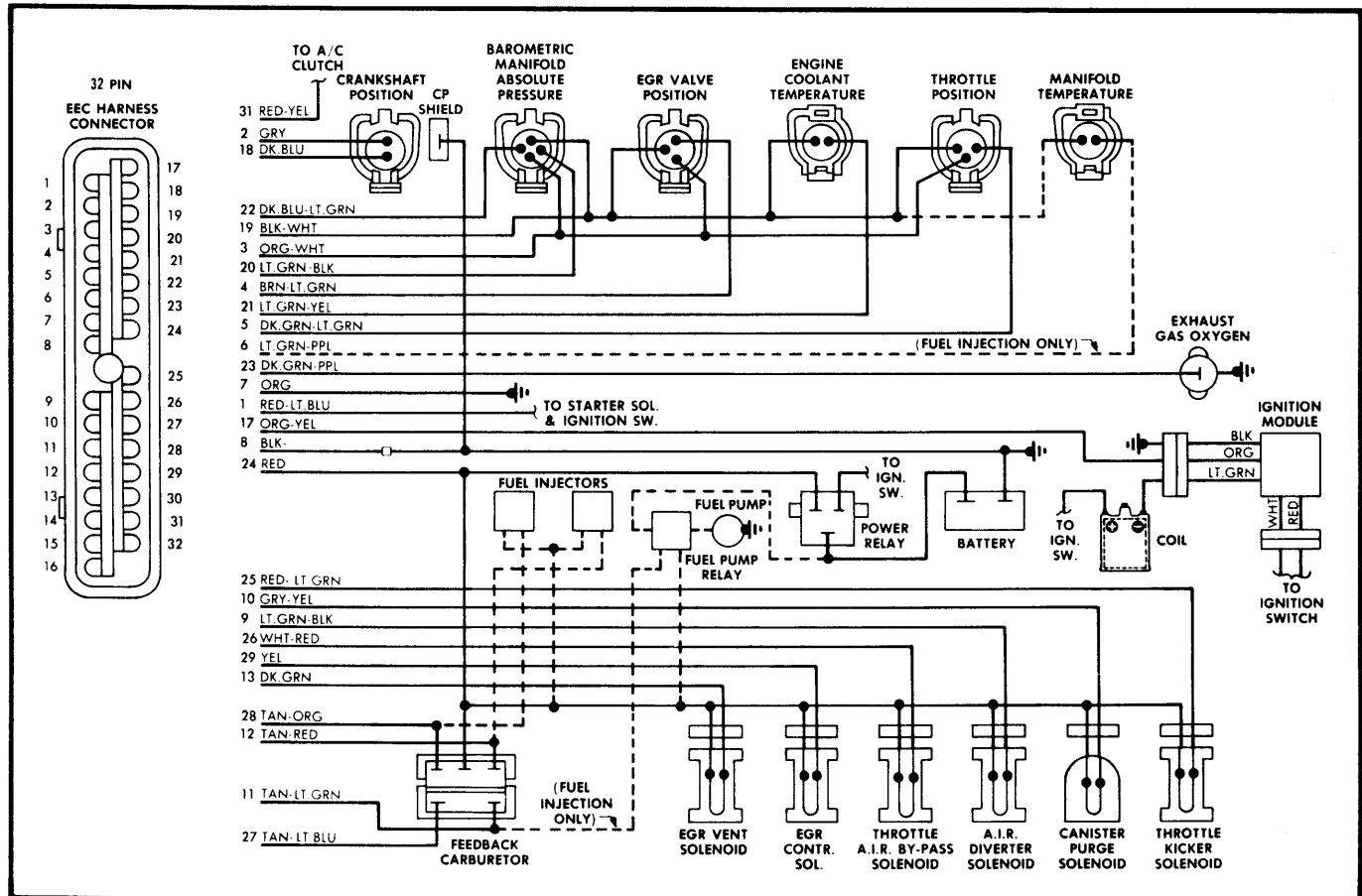


Fig. 3 1980 EEC III Wiring Diagram (EEC II Similar)

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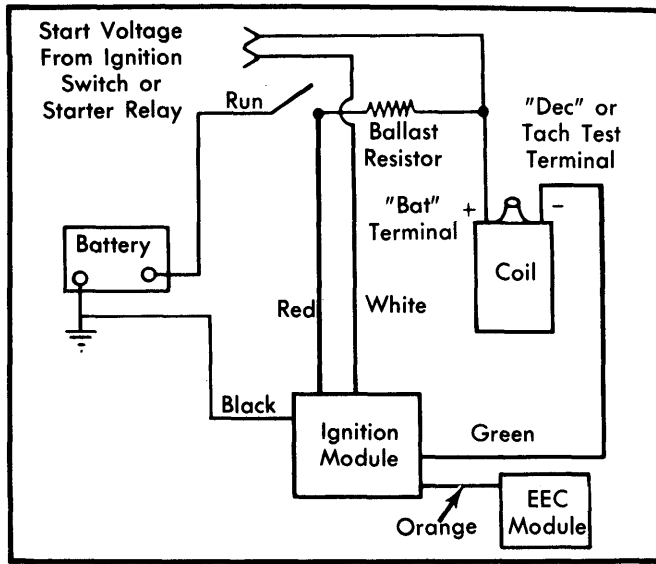


Fig. 4 EEC Ignition System Schematic

The sensor has slotted mounting holes to permit rotational adjustment. If sensor is replaced or if curb idle speed is adjusted, sensor must be positioned correctly or erroneous throttle position information will be sent to the ECA.

EGR Valve Position Sensor – Sensor monitors EGR valve position. This signals ECA on the amount of EGR flow.

Exhaust Gas Oxygen Sensor – Sensor is threaded into the right-hand exhaust manifold directly in the path of exhaust gas stream. EGO sensor provides information to the ECA about air/fuel ratio as indicated by the oxygen concentration of the exhaust gases.

TESTING

NOTE – The following procedures will test the Dura-Spark module as it relates to the control assembly. To test the rest of the ignition system (coil voltage output, power feed to ignition module) refer to MOTORCRAFT DURA-SPARK II IGNITION SYSTEMS in this section.

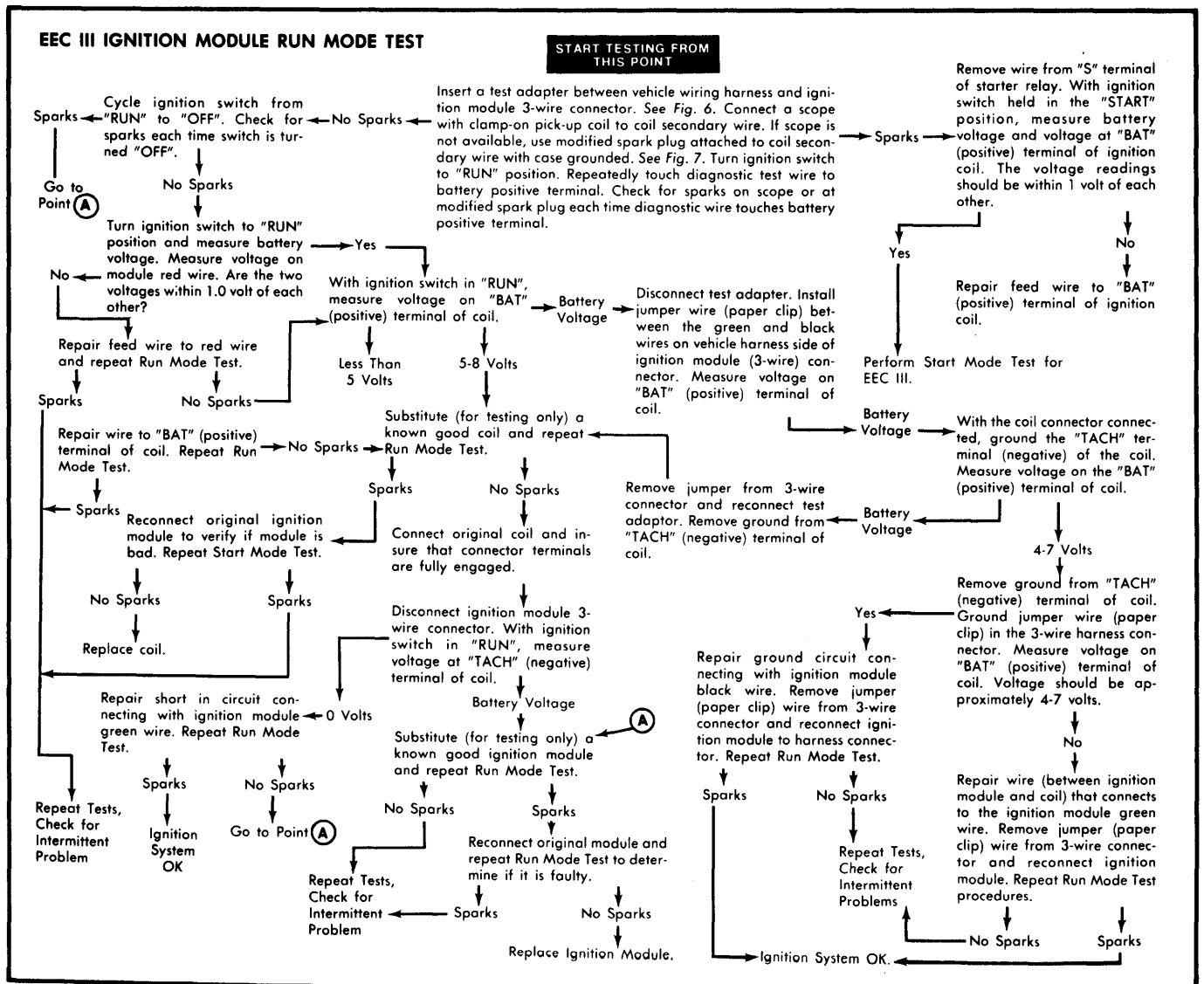


Fig. 5 EEC III Ignition Module Run Mode Test

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CAUTION — Different diagnostic and service procedures are required for EEC II than EEC III. To identify the EEC II vehicles, look for (1) silver engine decal rather than gold tone used for EEC III, (2) red vinyl tag near EEC module connector, marked "EEC II", (3) a paper tag on rear of calibration assembly, marked "GA" or "K" for EEC II, and (4) on EEC II vehicles, the calibration assembly does not fill out mounting area on processor assembly.

NOTE — On EEC II models, a retaining ring is used to hold the bolt in place in harness connector. If harness connector is removed from EEC II module, remove and discard retaining ring. If this ring is not removed, damage to module may result.

CAUTION — Whenever the EEC harness connector is removed from the processor assembly, use a torque wrench to tighten EEC connector retaining bolt to 20-25 INCH lbs. Damage to either EEC assembly or connector can result from over-tightening.

IGNITION MODULE START MODE TEST EEC III MODELS ONLY

NOTE — Perform Run Mode Test first, then perform this test, if necessary. Run Mode Test is found in Fig. 5.

1) Connect an adapter between ignition module 3-wire connector and harness connector. See Fig. 6. If adapter is not available use jumper wires to connect green wire on ignition module to green wire on harness connector, black wire on ignition module to black wire on harness connector, and an orange wire connected to orange wire of ignition module connector, but not attached to harness connector orange wire. This orange lead is used as the diagnostic lead. See Fig. 6.

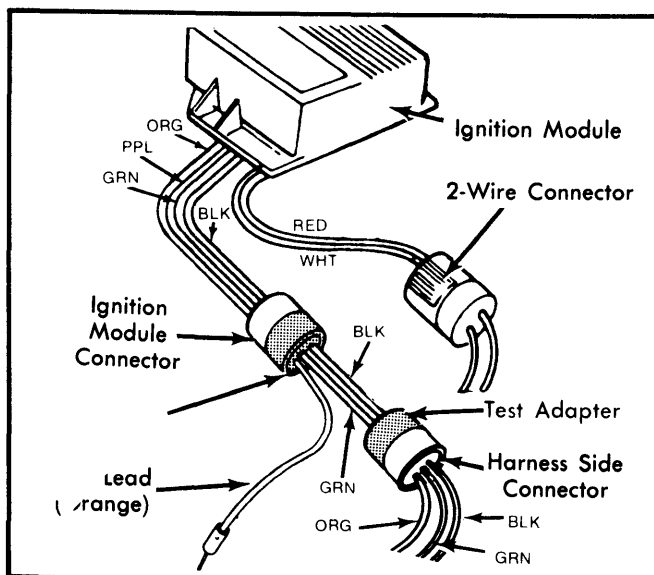


Fig. 6 Installation of Test Adapter or Jumper Wires for Performing EEC Diagnosis

2) Attach a modified spark plug to coil secondary wire. See Fig. 7. Turn ignition switch to "START" position and hold.

Repeatedly touch the orange diagnostic wire to battery positive terminal and then remove it. Watch for a spark at modified spark plug every time diagnostic wire is touched to battery positive terminal.

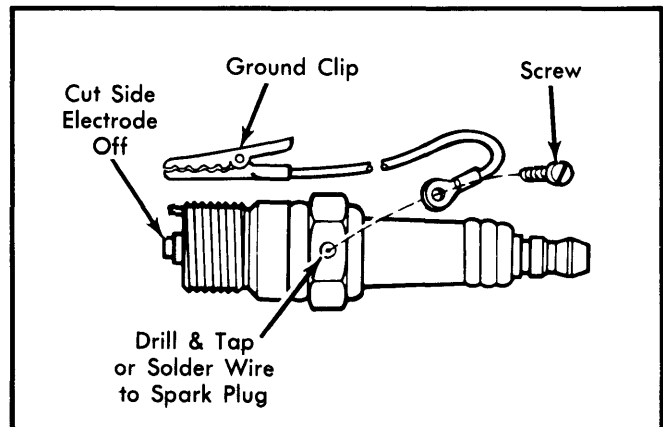


Fig. 7 Special Modified Spark Plug with Side Electrode Removed and Ground Wire Attached

3) If a spark occurs, ignition module is OK. If no spark occurs, measure battery voltage and voltage of the white wire (do not disconnect 2-wire connector), while holding ignition switch in "START" position. Voltages should be within 1.0 volt of each other.

4) If voltages are not the same, proceed to step 5). If voltages are the same, substitute a known good ignition module for testing. Repeat Start Mode Test, beginning at step 2). If modified spark plug does not spark, perform Ignition Module Run Mode Test. If modified spark plug sparks, proceed to step 6).

5) Repair white wire, connectors of the wire feeding power to white wire (check ignition switch, starter solenoid, etc.). If modified spark plug sparks after repairs, ignition system is OK. If plug still fails to spark, substitute a known good ignition module and start testing from step 4).

6) Reconnect original ignition module to make sure it is faulty. If modified spark plug sparks with old module, repeat tests, starting with Run Mode Test. If old module does not spark, install new ignition module.

IGNITION MODULE RUN MODE TEST EEC II MODELS ONLY

1) Insert test adapter between wiring harness and ignition module 4-wire connector. See Fig. 6. Connect a scope with clamp-on pick-up to coil secondary wire. If scope is not available, use a modified spark plug attached to coil secondary wire with plug case grounded. See Fig. 7. Turn ignition to "ON" position and ground the diagnostic test wire of adapter. Check for sparks each time wire is removed from ground.

2) If plug sparks, proceed to Ignition Module Start Mode Test for EEC II vehicles. If plug does not spark, turn ignition switch "ON" and "OFF", checking for sparks each time ignition is turned "OFF". If plug sparks, proceed to step 3). If plug does not spark, proceed to step 4).

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3) Remove test adapter and substitute (but do not install) a known good ignition module and attempt to start vehicle. If vehicle runs, reinstall old module to verify that it was faulty. If so, replace module. If vehicle runs with old module, repeat test procedure.

4) Turn ignition switch "ON" and measure battery voltage and voltage at ignition module red wire. If voltages are not equal, repair ignition module red wire circuit and attempt again to start vehicle. If vehicle will not start or if battery voltage and red wire voltage were equal, proceed to Ignition Module Final Test. See Fig. 8.

IGNITION MODULE START MODE TEST EEC II MODELS ONLY

1) With test adapter connected, crank engine and repeatedly touch diagnostic test wire to battery positive terminal and check for sparks at modified spark plug. See Figs. 6 and 7. If plug sparks, remove test equipment and start vehicle. If vehicle will not start, proceed to EEC II Ignition Module Final Test. See Fig. 8. If plug sparks, proceed to step 2).

2) Remove test adapter and reconnect ignition module. Measure battery voltage while cranking engine and then measure voltage at ignition module white wire. If voltages are equal, proceed to step 3). If voltages are not equal, repair ignition module white feed wire and attempt to start vehicle. If vehicle fails to start, proceed to step 3).

3) Substitute a known good ignition module and repeat EEC II Ignition Module Run Mode Test. Repeat step 1). If plug sparks, reinstall old module to verify that it was faulty. Replace ignition module, if faulty. If plug does not spark with new module, repeat testing procedure beginning with EEC II Ignition Module Run Mode Test.

EEC ELECTRONIC CONTROL ASSEMBLY (ECA) TEST

Due to the complexity of the EEC system, two special diagnostic aids are required. One is a digital Volt/Ohmmeter. This is a highly accurate, high input impedance meter that is more accurate than the conventional Volt/Ohmmeter using a needle.

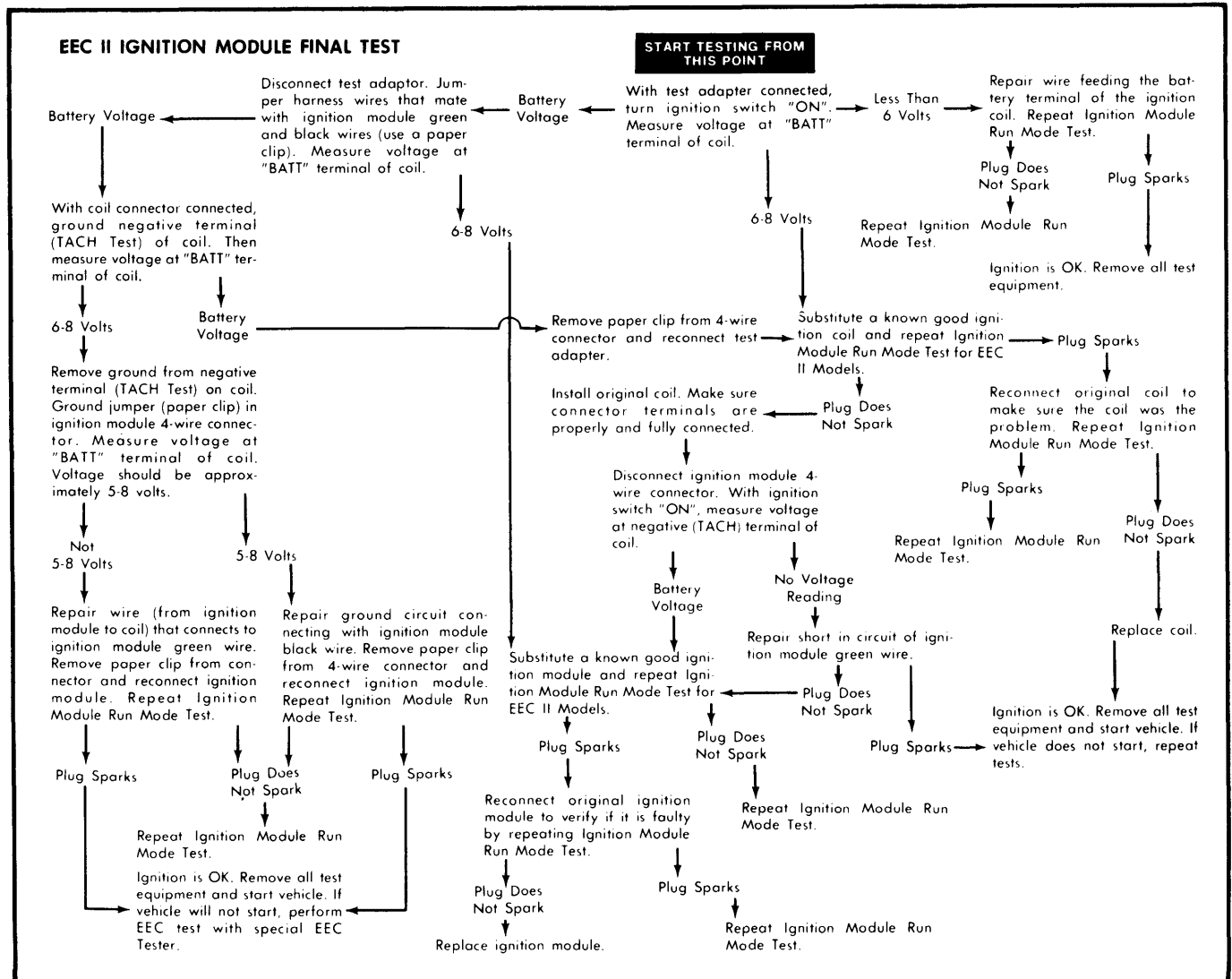


Fig. 8 EEC II Ignition Module Final Test

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The second diagnostic aid is the special EEC System Diagnostic Tester for the specific system being tested. The testers plug into the vehicle harness between the EEC ECA and the vehicle's wiring harness. Testing instructions are given in the operator's manual furnished with the tester. Diagnostic limits for spark advance and EGR valve position sensor are located on vehicle emission control information decal on engine valve cover.

Other equipment needed to test the EEC ECA includes a timing light compatible with the Dura-Spark system, a pressure/vacuum gauge and an accurate tachometer.

REMOVAL & INSTALLATION

ROTOR

Removal (Early Design) – 1) Remove distributor cap and rotate crankshaft to align distributor upper blade (with slot) with locating slot in distributor adapter. Drop alignment tool (T78P-12200A) into place.

NOTE – If rotor or adapter is damaged and alignment is not possible, position crankshaft with No. 1 piston at compression TDC by aligning zero mark on damper with timing pointer on front cover.

2) Remove rotor alignment tool and remove 2 screws attaching rotor to distributor shaft. Remove rotor.

CAUTION – DO NOT rotate crankshaft after rotor has been removed.

Installation (Early Design) – 1) Coat lower electrode blades with silicone grease to a $\frac{1}{32}$ " thickness.

2) Place new rotor on distributor shaft with slot in upper blade pointing to locating notch in distributor adapter. Install, but do not tighten, both attaching screws.

3) Position rotor alignment tool (T78P-12200A) in distributor adapter so tang on underside of tool engages locating notch in distributor adapter and slot in rotor at same time.

4) Tighten both rotor attaching screws to 15-20 INCH lbs. Remove rotor alignment tool and reinstall distributor cap. Seat both cap-to-adapter spring clips.

Removal (Later Design) – Remove distributor cap. Remove rotor by pulling up on rotor pull tab. Rotor is held in place by a spring clip.

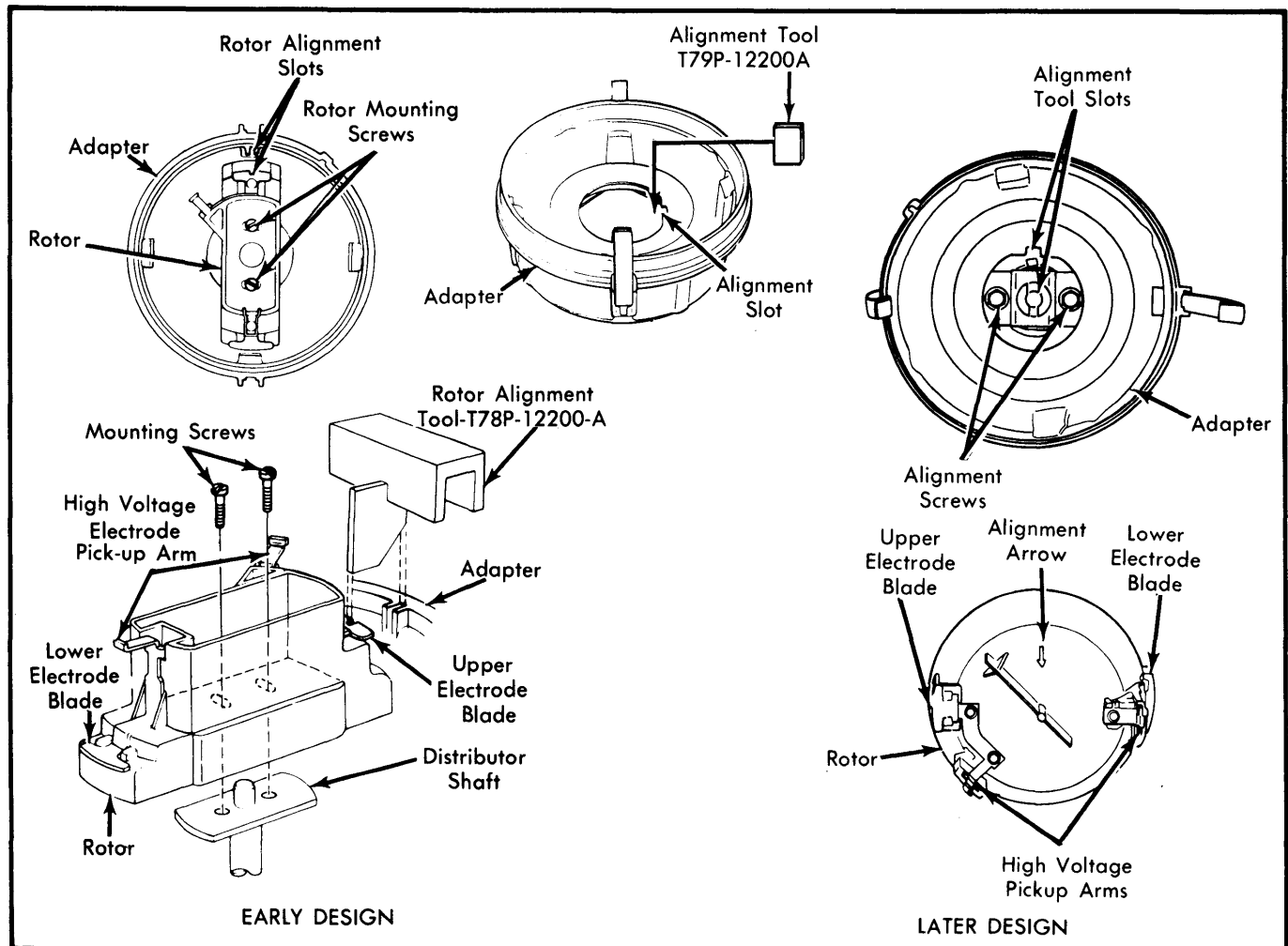


Fig. 9 Early and Later Design EEC Distributor Rotor Alignment

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NOTE — Rotor removal is only necessary when replacing rotor or adapter. No adjustment of distributor is required if rotor is replaced.

Installation (Later Design) — 1) Coat upper and lower electrode blades of rotor and also 4 arms of distributor cap's brass center plate with silicone grease to a $\frac{1}{32}$ " thickness.

2) If alignment is necessary, rotate crankshaft until engine timing pointer is aligned with timing mark on engine damper. Insure that No. 1 piston is on compression stroke and not on exhaust stroke (otherwise distributor rotor would be 180° out of alignment). Loosen 2 sleeve assembly adjustment screws and rotate sleeve until alignment tool (T79P-12200A) fits into alignment slots. Tighten adjustment screws and remove tool.

3) Align arrow molded into top of rotor with large key way slot in distributor sleeve. Press down on rotor until retaining spring snaps into place.

DISTRIBUTOR

Removal (Early Design) — 1) Position rotor alignment tool (T78P-12200A) as described under rotor removal. With rotor alignment tool inserted, loosen distributor hold-down bolt and clamp. Remove alignment tool.

2) Slowly remove the distributor assembly from engine block, noting position of rotor blade to distributor base when cam and distributor drive are felt to disengage.

CAUTION — DO NOT rotate crankshaft after distributor rotor has been removed.

Installation (Early Design) — 1) Position distributor in engine and insure that slot on distributor base hold-down flange is aligned with clamp bolt hole in block and slot in upper blade of rotor is about aligned with slot in adapter.

2) If alignment is not possible, raise distributor and rotate distributor shaft slightly to allow next tooth on distributor drive gear to engage cam gear. Install clamp and bolt.

3) Align rotor and install distributor cap.

Removal (Later Design) — 1) Remove distributor cap and rotor. Rotate crankshaft to correct timing mark.

NOTE — The EEC distributor is locked into place during assembly so that no rotation adjustment is possible. A slot in distributor base mounting flange closely fits around distributor clamp hold-down bolt, preventing movement. Adjustment is never required or permitted, because all timing control is handled by ECA and rotor alignment is critical. If distributor replacement is required, this procedure should be followed.

2) The alignment slot in sleeve assembly should be lined up with slot in adapter. Remove distributor hold-down bolt and clamp.

3) Slowly remove distributor assembly from engine. Note position of large slot in sleeve with respect to adapter alignment slot when cam and distributor gear disengage.

CAUTION — DO NOT rotate crankshaft after distributor has been removed.

Installation (Later Design) — 1) Install distributor in engine so that slot on distributor base hold-down flange is aligned with clamp bolt hole in block.

2) The large slot in distributor sleeve assembly should be approximately aligned with slot in adapter.

3) If alignment is not possible, raise distributor and rotate distributor shaft slightly to allow next tooth of distributor drive gear to engage cam gear. Install hold-down clamp.

4) Align sleeve and install distributor cap following rotor installation procedures.