MOTORCRAFT DURA-SPARK II IGNITION SYSTEMS

Ford Motor Co.
All Except Models Equipped with EEC and Front Wheel Drive Models with Auto. Trans.

DESCRIPTION

Dura-Spark II – Dura-Spark II is basically a solid-state ignition system, consisting of a breakerless distributor, electronic control module, ignition coil, battery, ignition switch, secondary wires and various wiring harnesses. See *Figs. 1 and 4.*

Most models use a large rotor, a distributor cap and adapter (no adapter on front wheel drive models), secondary wires, and wide gap spark plugs to take advantage of higher energy produced in the Dura-Spark II ignition system. The Dura-Spark II system can be identified by the module's 2-wire and 4-wire connectors. See *Figs. 1 and 3.*

Dura-Spark II with Dual Mode Timing – Some models have a special electronic control module with a third connector with 3 wires. See *Fig. 2.* This connector attaches to a special switch. The switch is either a distributor vacuum modulator valve, used on engines with the fuel economy package, or an ignition barometric pressure switch, used on altitude calibration vehicles.

This switch allows base engine timing to be modified to suit either altitude or engine load conditions. All other operating characteristics of the module are the same as for Dura-Spark II systems without the special switch.

OPERATION

The Dura-Spark II systems contain a distributor, electronic control module and ignition coil and function much the same as other solid state systems. See *Figs. 1 and 2.* An armature on the distributor shaft rotates past a stator (pick-up coil).

The armature has the same number of teeth as the engine has cylinders. As the teeth rotate past the pick-up coil, a signal is sent to the electronic control module.

The module then determines when to turn current off and on in the primary windings of the ignition coil. This current collapse in the primary, causes a high voltage surge in the secondary, which is routed to the spark plugs through the rotor, distributor cap and spark plug wires. System components include the following:

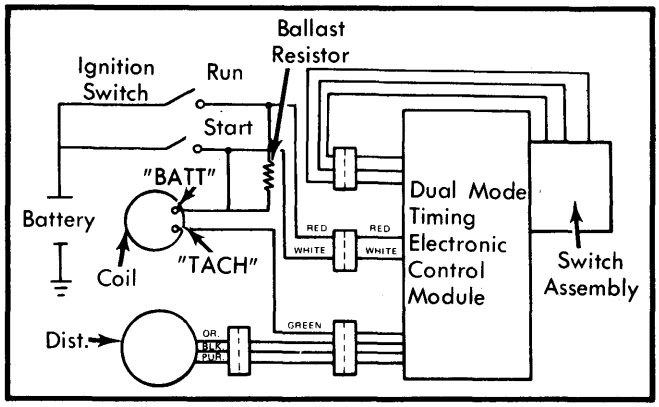

Fig. 2 Dura-Spark II System with Dual Mode Timing Electronic Control Module (Used on Some Fuel Economy and Altitude Models)

Electronic Control Module – Each Dura-Spark II module has 6 wires (a 2-wire and a 4-wire connector). See *Figs. 1 and 3.* Modules with dual mode timing have an additional 3-wires leading to one 3-wire connector. The Red and White wires are the ignition feed wires (the White wire is for cranking and Red wire is for operation after the engine is running). The Red wire circuit contains a 1.1 ohm resistance wire. The current to the primary circuit of the ignition coil is turned off and on through the Green wire. The Orange and Purple wires transmit signals to the electronic control module from the reluctor (armature) and pick-up coil (stator) in the distributor. The Black wire is used to ground the electronic control module through the distributor housing. On models with dual mode timing, the additional 3 wires connect to either a vacuum modulator valve or a barometric pressure switch.

Distributor – A reluctor, containing the same number of teeth as the engine has cylinders, turns with the distributor shaft. The pick-up coil contains a permanent magnet, causing a magnetic field around the pick-up coil. As the teeth of the reluctor pass the pick-up coil the magnetic field builds and collapses, causing a signal to be sent to the electronic control module. In turn, the control module turns the ignition coil primary off and on, causing a high voltage surge in the secondary.

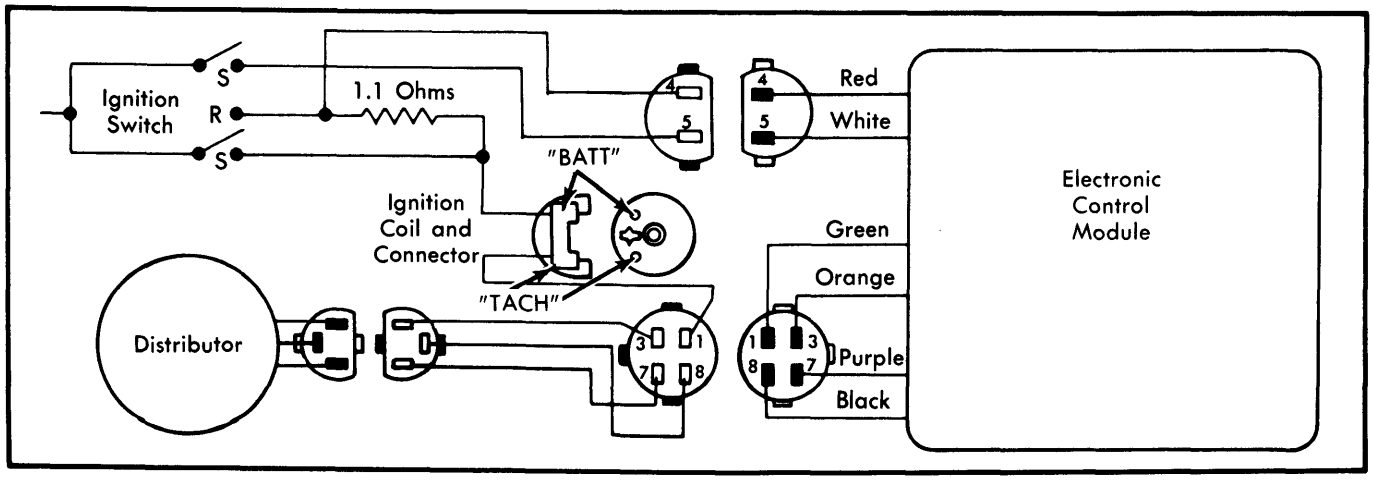

Fig. 1 Dura-Spark II Ignition System Wiring Diagram

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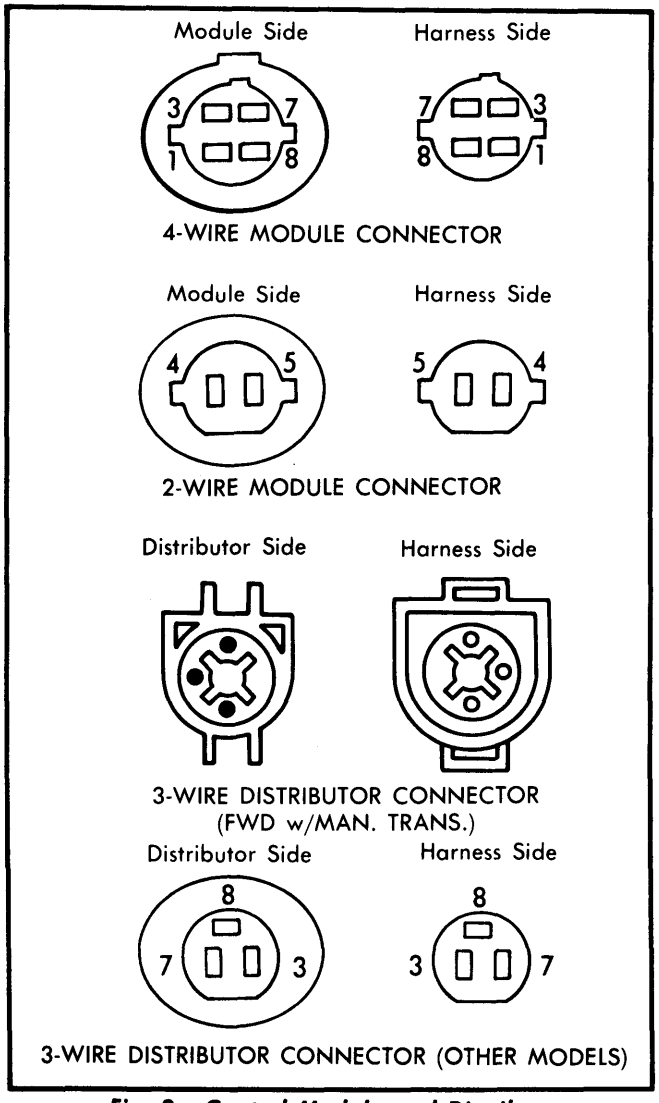

Fig. 3 Control Module and Distributor Connectors for Dura-Spark II

Dura-Spark II systems (except front wheel drive models) have an adapter between the distributor housing and cap. *See Fig. 4.* Distributor caps are larger than for conventional distributors and have male terminals. Distributors have both centrifugal and vacuum advance mechanisms.

On single diaphragm vacuum units, increased vacuum causes the movable pick-up coil to pivot on the lower plate assembly, advancing spark timing. On dual diaphragm units, the outer (primary) diaphragm operates from carburetor vacuum to provide timing advance during normal idle off driving conditions. It is connected to the pick-up coil assembly.

The inner (secondary) diaphragm operates from intake manifold vacuum and acts to retard ignition timing. The inner diaphragm is connected to the outer diaphragm by means of sliding linkage. Stronger intake manifold vacuum can override carburetor vacuum during closed throttle operation, retarding spark timing.

Distributors on 4-cylinder and 6-cylinder models rotate clockwise, those of V8 models, counterclockwise.

Distributors for front wheel drive models differ from other models in that they are tang driven by the front end of the camshaft. They have no distributor cap adapter, and centrifugal advance mechanisms are mounted above the reluctor and pick-up coil assemblies. *See Fig. 4.* A large, circular rotor provides a dielectric shield over the centrifugal advance mechanism.

Ignition Coil – Coils are oil filled and are energized whenever the ignition switch is in the "ON" or "START" position. They contain a positive "BATT" terminal and a negative "TACH" (sometimes called "DEC") terminal and a single secondary terminal. A special connector attaches the green wire from the control module to the negative terminal ("TACH") and the wire from the ignition switch to the positive terminal ("BATT").

NOTE – *"DEC" refers to Distributor Electronic Control. This terminal is also referred to as the "Tach Test" terminal.*

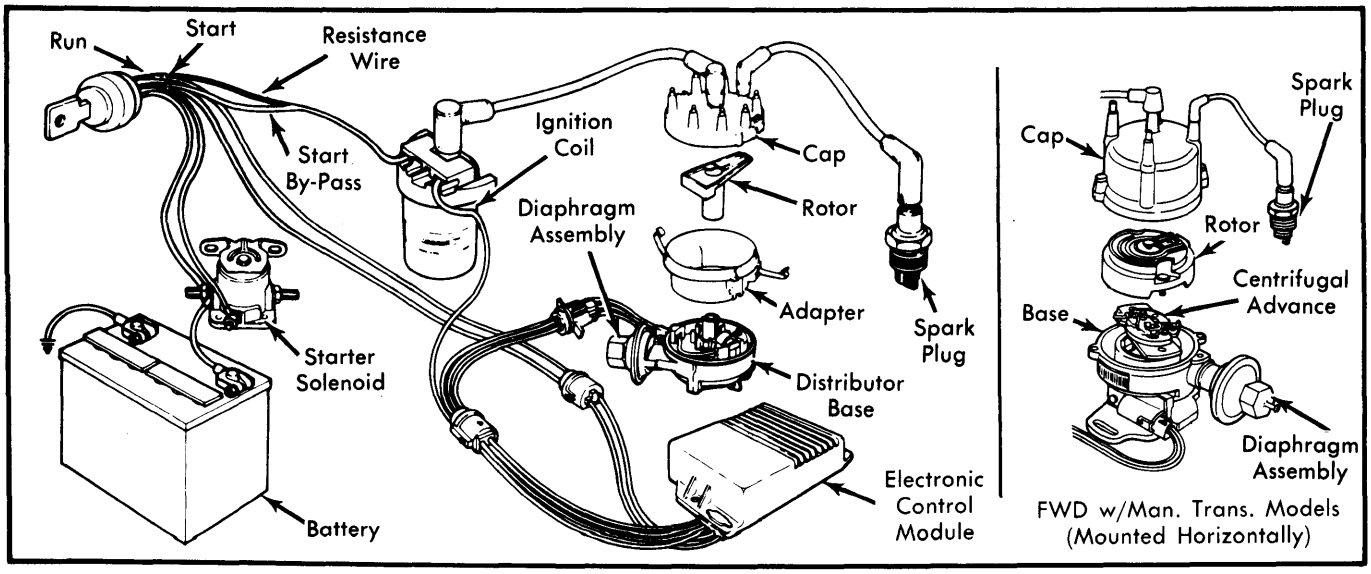

Fig. 4 Schematic of Dura-Spark II Ignition System

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Resistance Wire – The special ignition resistance wire in the Red wire circuit must be of specified length and diameter to reduce operating voltage. Under no circumstances should it be replaced by any other wire other than correct service resistance wire. When new wire is installed, old wire should be removed from system. Resistance value of wire is 1.0-1.1 ohms.

System Protection – Dura-Spark systems are protected against electrical currents produced or used by any other vehicle component during normal operation. However, damage to the ignition system can occur if proper testing procedures are not followed.

DURA-SPARK II SYSTEM PRECAUTIONS

Since the electronic control module and ignition coil are "ON" whenever the ignition switch is in the "ON" or "START" position, the system will generate a spark whenever the ignition switch is turned "OFF". This feature may be used as a diagnostic tool to check for continuity of circuit, coil and ignition switch. As spark may occur if distributor cap is removed with switch "ON", keep switch "OFF" during underhood operations, unless you plan to start the engine or perform a test requiring the switch to be "ON". This will prevent accidental engine rotation during service or test procedures.

Silicone dielectric grease must be applied to all insulating areas at distributor, coil and spark plug boots.

A ¾" clearance must be maintained at distributor cap mounting edge, spark plug wire terminals, and coil tower to prevent high voltage arc to ground.

To help prevent radio frequency interference, coat the entire brass rotor tip with silicone dielectric grease to a thickness of 1/32". Do not remove this grease, even if discolored, as the grease will maintain its insulating properties.

When replacing spark plug wires, insure wire made of the same material is used for a replacement. Silicone/Silicone wire can be identified by the letters "SS" appearing on the wire in WHITE lettering. Silicone/EPDM wire can be identified by the letters "SE" appearing on the wire in BLACK lettering. The "SS" wire is used on cylinders subject to very high engine temperatures.

When removing distributor cap and adapter, always remove the distributor cap first, then the adapter.

ADJUSTMENTS

No adjustments are to be made to the ignition system except initial engine timing and spark plug gap.

TESTING

NOTE – *All wire colors shown refer to colors of electronic control module wires. When making tests, wires must be traced back to control module for proper color identification. Also, when a test is completed and a problem is found, make the necessary repair and repeat the failed test to be sure that problem has been corrected.*

CAUTION – *When checking the secondary voltage, do not remove the following spark plug wires while the engine is running or cranking:*

- Plug No. 1 or 8 on V8 engines.
- Plug No. 3 or 5 on 6 Cylinder engines.
- Plug No. 1 or 3 on 4 Cylinder engines

TEST SPARK PLUG

Either use a spark tester tool or modify a spark plug (cut off side terminal and install spring clip for grounding plug housing) for use in testing ignition system. *See Fig. 5.*

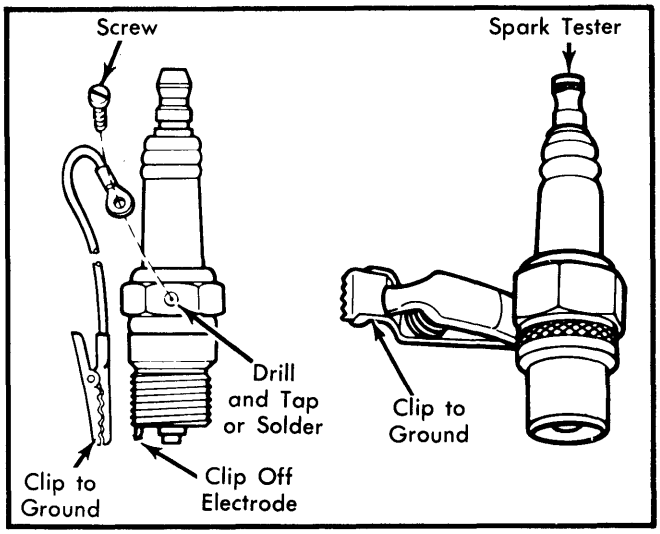

Fig. 5 Modified Spark Plug and Spark Tester

START CIRCUIT CHECK

1) Connect spark tester or modified spark plug between ignition coil wire and a good engine ground. Crank engine with ignition switch. If no sparks occur at tester gap, proceed to step **2)**. If sparks occur at tester gap, proceed to "Run Circuits Check".

2) If no sparks occurred in step **1)**, remove coil wire from distributor cap and ignition coil. Connect ohmmeter leads to both ends of coil wire and measure resistance. If resistance is more than 5,000 ohms per inch, replace coil wire. Also inspect ignition coil for damage or carbon tracking. Crank engine to verify distributor rotation and proceed to "Voltage Supply Circuits Check".

RUN CIRCUITS CHECK

1) Remove ignition coil wire from distributor cap and install spark tester on wire. Turn ignition switch from "OFF" to "RUN" to "OFF" several times. Sparks should occur at tester gap each time switch goes from "RUN" to "OFF" position. Remove spark tester and reconnect coil wire to distributor cap.

2) If sparks occur, check distributor cap, adapter (if equipped) and rotor for cracks, carbon tracking or lack of silicone compound. Also check for roll pin retaining reluctor to sleeve in dis-

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tributor shaft and check that Orange and Purple wires are not crossed between distributor and control module.

3) If no sparks occurred in step **1)** , proceed to "Control Module Voltage Check".

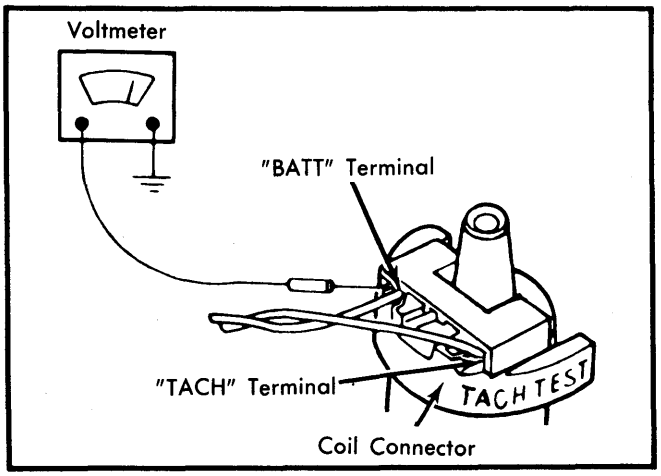

Fig. 6 Checking for Battery Voltage at Ignition Coil Positive ("BATT") Terminal

CONTROL MODULE VOLTAGE CHECK

1) With ignition switch "OFF", carefully insert small straight pin in Red module wire. *See Fig. 7.* Attach negative voltmeter lead to distributor base and positive lead to straight pin. Measure battery voltage.

2) Again measure voltage at straight pin in Red wire but with ignition switch in "RUN" position. After reading voltmeter, turn ignition switch "OFF" and remove straight pin.

3) Voltmeter should read at least 90 percent of battery voltage. If so, proceed to "Resistance Wire Check". If reading was less than 90 percent of battery voltage, check wiring harness between control module and ignition switch. Also check for a worn or damaged ignition switch.

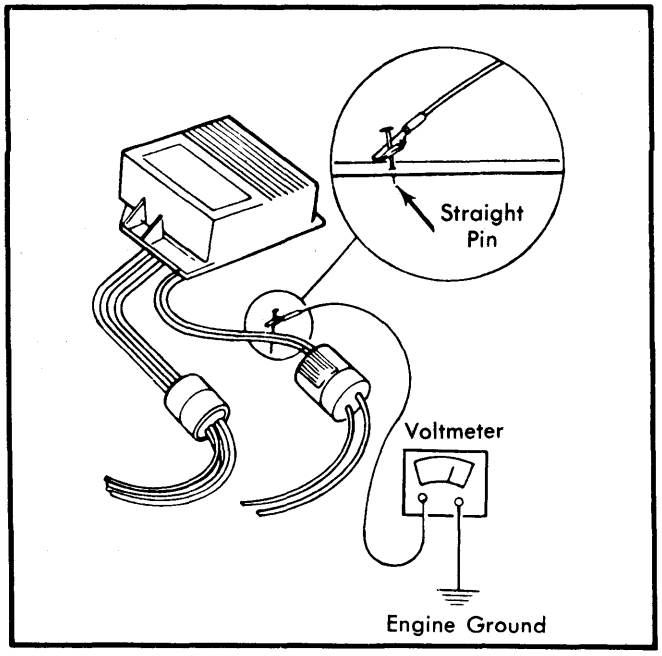

Fig. 7 Checking Control Module Run and Start Circuits with Voltmeter

RESISTANCE WIRE CHECK

1) Disconnect control module 2-wire connector and remove coil connector from coil. Connect ohmmeter leads to "BATT" terminal of coil connector and to harness connector terminal mating with Red control module wire. Read ohmmeter, then reconnect all connectors.

2) If resistance is 0.8-1.6 ohms, problem is either intermittent or not in ignition system. If resistance was less than 0.8 or more than 1.6 ohms, replace resistance wire.

VOLTAGE SUPPLY CIRCUITS CHECK

1) If starter relay has an "I" terminal, disconnect cable between relay and starter motor at starter relay. If starter relay does not have an "I" terminal, disconnect wire to "S" terminal of starter relay. Insert small straight pins in Red and White control module wires.

CAUTION — *Do not allow straight pins to contact an electrical ground.*

2) Measure battery voltage, connect negative voltmeter lead to distributor base, and note voltmeter reading in each of the following situations:

- Positive voltmeter lead connected to pin in Red wire with igntion switch in "RUN" position.
- Positive voltmeter lead connected to pin in White wire with ignition switch in "START" position.
- Positive voltmeter lead connected to "BATT" terminal of ignition coil with ignition switch in "START" position.

3) Turn ignition switch "OFF", reconnect any wires disconnected from starter relay, remove voltmeter leads and remove straight pins from wires. If voltage readings were at least 90 percent of battery voltage, test result is OK, proceed to "Ignition Coil Voltage Supply Check". If reading was less than 90 percent of battery voltage, check for faulty wiring harness or connectors. Also check for worn or damaged ignition switch.

IGNITION COIL VOLTAGE SUPPLY CHECK

1) Connect negative lead of voltmeter to distributor base and positive lead to "BATT" terminal of ignition coil. Turn ignition switch to "RUN" position and read voltmeter. Turn ignition switch to "OFF" position.

2) If voltage was 6-8 volts, proceed to "Pick-Up Coil Assembly & Distributor Wiring Harness Check". If voltage was less than 6 volts or more than 8 volts, proceed to "Ignition Coil Primary Resistance Check".

PICK-UP COIL ASSEMBLY & DISTRIBUTOR WIRING HARNESS CHECK

1) Disconnect control module 4-wire connector and inspect for dirt, corrosion or damage. Connect ohmmeter leads to connector terminals that mate with Orange and Purple control module wires.

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2) Resistance should be 400-1,300 ohms. If so, proceed to "Control Module to Distributor Wiring Harness Check". If resistance is not to specifications, proceed to "Pick-Up Coil Resistance Check".

CONTROL MODULE TO DISTRIBUTOR WIRING HARNESS CHECK

1) Disconnect 4-wire control module connector. Connect one lead of ohmmeter to distributor base. Alternately, connect the other ohmmeter lead to wiring harness connector terminals that mate with Orange and Purple wires of control module connector.

2) If resistance is greater than 70,000 ohms, test result is OK, proceed to "Ignition Coil Secondary Resistance Check". If resistance was less than 70,000 ohms, check wiring harness between control module connector and distributor, including distributor grommet.

IGNITION COIL SECONDARY RESISTANCE CHECK

1) Disconnect ignition coil wire and ignition coil connector from coil. Connect ohmmeter leads to ignition coil "BATT" terminal and to high voltage terminal. Measure resistance and reconnect wire and connector.

2) If resistance is 7,700-10,500 ohms, coil is OK, proceed to "Module-to-Coil Wire Check". If resistance is less than 7,700 or greater than 10,500 ohms, replace ignition coil.

MODULE-TO-COIL WIRE CHECK

1) Disconnect control module 4-wire connector and ignition coil connector. Connect one ohmmeter lead to distributor base and the other to "TACH" terminal of ignition coil connector. Measure resistance and reconnect all connectors.

2) If resistance is greater than 1 ohm, replace control module. If resistance is 1 ohm or less, inspect wiring harness between control module and ignition coil.

PICK-UP COIL RESISTANCE CHECK

1) Disconnect distributor connector from wiring harness. Connect ohmmeter leads to distributor connector terminals that mate with Orange and Purple wires of control module connector. Measure resistance of pick-up coil then reconnect distributor connector to wiring harness.

2) On rear wheel drive models, resistance should be 400-1,000 ohms. On front wheel drive models, resistance should be 650-1,300 ohms. If resistance is within this range, pick-up coil is OK. If resistance is not within specified range, replace pick-up coil assembly.

IGNITION COIL PRIMARY RESISTANCE CHECK

1) Disconnect ignition coil connector. Connect ohmmeter leads to "BATT" and "TACH" terminals of ignition coil. Measure resistance and reconnect ignition coil connector.

2) If resistance is 0.8-1.6 ohms, coil is OK, proceed to "Primary Circuit Continuity Check". If resistance is less than 0.8 or greater than 1.6 ohms, replace ignition coil.

PRIMARY CIRCUIT CONTINUITY CHECK

1) Insert a small straight pin in control module Green wire. Connect negative voltmeter lead to distributor base and positive lead to pin in Green wire. With ignition switch in "RUN" position, measure voltage. Turn ignition switch "OFF" and remove straight pin from Green wire.

2) If voltage reading was greater than 1.5 volts, proceed to "Ground Circuit Continuity Check". If voltage reading was 1.5 volts or less, replace control module.

GROUND CIRCUIT CONTINUITY CHECK

1) Insert a small straight pin in control module Black wire. Connect negative lead of voltmeter to distributor base and positive lead to straight pin in Black wire. With ignition switch in "RUN" position, measure voltage. Turn ignition switch "OFF" and remove straight pin.

2) If voltage reading was greater than 0.5 volts, proceed to "Distributor Ground Circuit Continuity Check". If voltage was 0.5 volts or less, replace control module.

DISTRIBUTOR GROUND CIRCUIT CONTINUITY CHECK

1) Disconnect distributor connector from wiring harness. Connect ohmmeter leads to distributor base and to Black wire terminal in distributor connector. On front wheel drive models, the wire color cannot be seen without removing connector hold-down plate. Measure resistance, then reconnect distributor connector to wiring harness.

2) If resistance was less than 1 ohm, circuit is OK. If resistance was greater than 1 ohm, check ground screw in distributor housing.

SPARK PLUG WIRE RESISTANCE CHECK

1) Remove distributor cap and disconnect spark plug end of suspected wire or wires. Connect ohmmeter leads to spark plug terminal and terminal inside distributor cap (each end of wire).

CAUTION — *Never puncture a spark plug wire when measuring resistance.*

2) If resistance is less than 5,000 ohms per inch, visually inspect wires for damage and remove spark plug for inspection and/or replacement. If resistance is greater than 5,000 ohms per inch, disconnect suspected wire from distributor cap and again connect leads to each end of wire.

3) If resistance is now less than 5,000 ohms per inch, inspect distributor cap and spark plug wire terminals for damage. Repair as necessary. If resistance is still greater than 5,000 ohms per inch, replace wire(s).

OVERHAUL

FRONT WHEEL DRIVE MODELS

Disassembly – **1)** Remove secondary wire, distributor cap hold-down screws and cap. Pull cap straight off distributor to prevent rotor blade or spring damage.

2) Loosen rotor hold-down screws and remove rotor straight off weight plate to prevent damage to centrifugal advance mechanism.

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3) Disconnect vacuum line from diaphragm assembly. Remove retaining screws and save for later installation. Partially remove diaphragm assembly until it clears distributor housing, and then tilt assembly to disengage rod from stator pivot pin.

NOTE – *If further disassembly is necessary, replace distributor as an assembly.*

Reassembly – Reverse removal procedure, making sure to check condition of diaphragm assembly "O" ring. Also be sure diaphragm assembly rod properly engages stator pivot pin. Position distributor rotor with square and round locator pins matched to weight plate. Also note square alignment locator when installing distributor cap.

ALL EXCEPT FRONT WHEEL DRIVE MODELS

Disassembly – **1)** Remove distributor cap, adapter and rotor. Disconnect distributor wiring harness plug. Using a small gear puller or two screwdrivers, carefully pry armature from sleeve and plate assembly. Remove spring pin.

CAUTION – *Do not pinch stator wires when removing armature.*

2) On V8 engines, remove large wire retaining clip from base plate annular groove. Remove ground screw base and pull up to remove rubber grommet from base. Remove "E" clip securing diaphragm rod advance link to stator assembly. Lift diaphragm rod off post on stator assembly, and move it out against housing. Remove stator assembly.

3) On 4 cylinder and 6 cylinder models, remove "E" clip washer and wave washer securing stator assembly to lower plate. Remove stator assembly ground screw and lift assembly from distributor.

Reassembly – Reverse disassembly procedure, but use new roll pin and install roll pin in different groove, 180° from original groove.

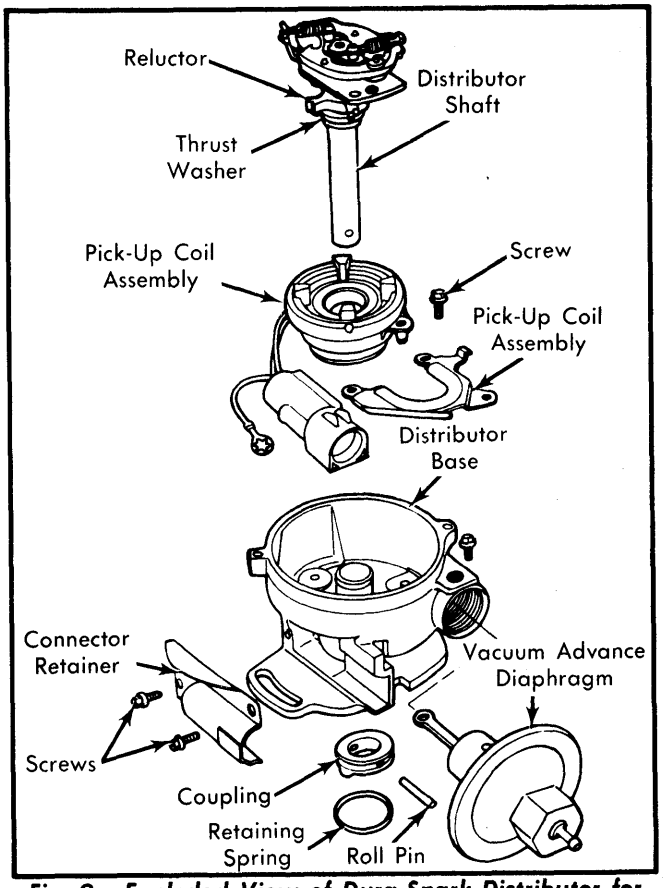

Fig. 9 Exploded View of Dura-Spark Distributor for Front Wheel Drive Models w/Man. Trans.

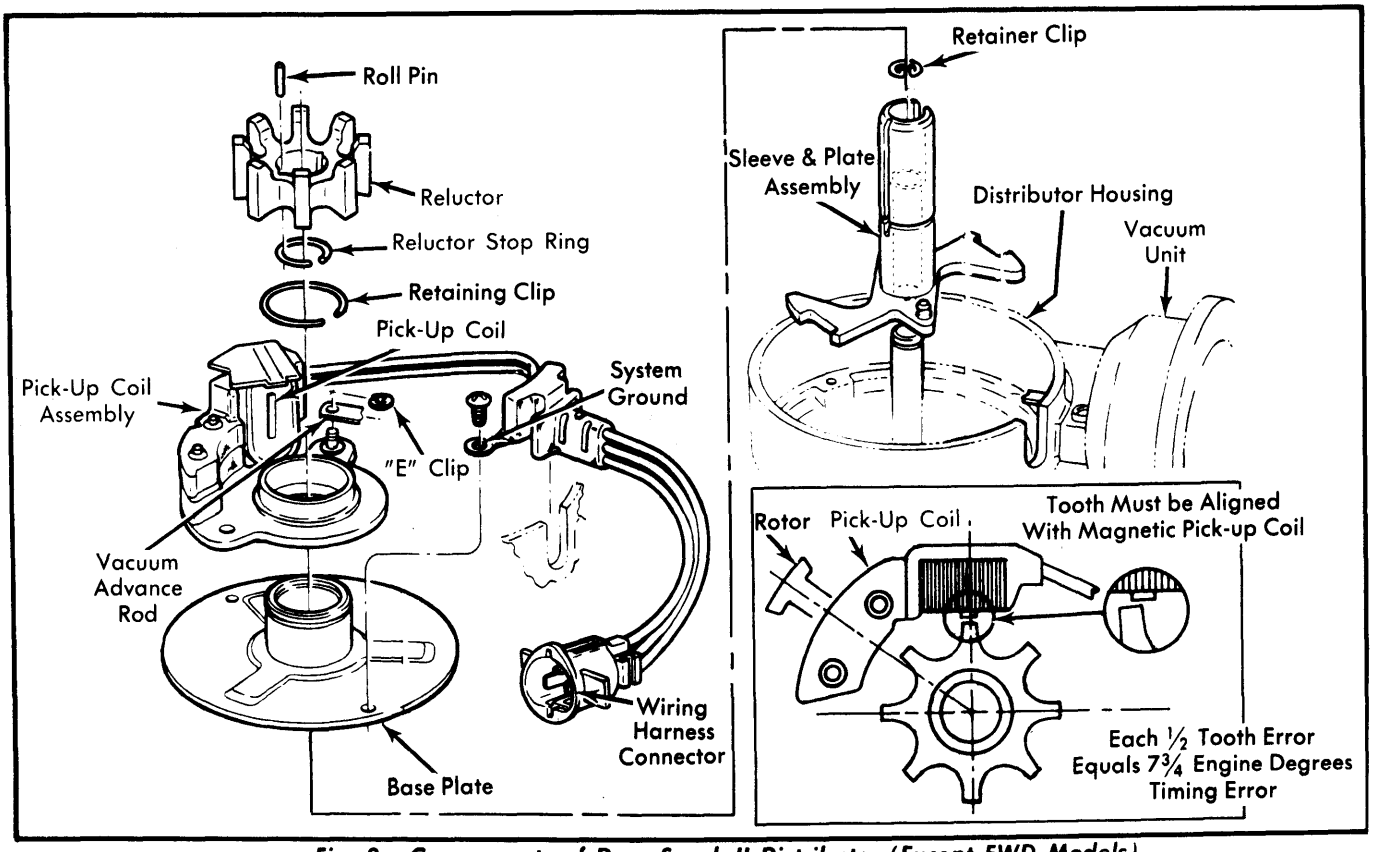

Fig. 8 Components of Dura-Spark II Distributor (Except FWD Models)