

# Distributors & Ignition Systems

## MOTORCRAFT DURA-SPARK I & II IGNITION SYSTEMS

Ford Motor Co.

### DESCRIPTION

**Dura-Spark I** — This new system is used only on California engines using V8 and six cylinder engines.

**Dura-Spark II** — This system is nearly the same as the Ford Solid State Ignition of previous years, but it does use some of the new components of the Dura-Spark I system. This system is used on all Federal models and the California four cylinder engine.

Both systems use the same distributor, distributor cap and adapter, rotor, spark plugs, and spark plug cables. The ignition coils, electronic control modules, and ignition system primary wiring are different. The Dura-Spark I system does not use a ballast resistor. On Dura-Spark I, the wiring harness connector at the control module is red and the top of the ignition coil is grey. On Dura-Spark II, the harness connector at the control unit is blue. The two control modules are not interchangeable.

### OPERATION

Both Dura-Spark systems function the same, except through the ignition primary circuit. These differences are built into the electronic control module. On Dura-Spark I systems, the module contains a coil current regulator. This regulator will turn off current to the coil within one second after it senses that the distributor is not rotating. To turn the primary circuit back on, the ignition switch must be turned to the START position. On Dura-Spark II, the ignition primary circuit is on any time the ignition switch is on.

**Electronic Control Modules** — Each module uses six wires. The Red and White wires are ignition feed. The White wire is ignition primary circuit while engine is cranking; the Red wire is ignition primary with engine running. On Dura-Spark II, the red wire circuit contains the ballast resistor. The primary current is turned on and off by the control unit through the Green wire between the module and coil. The Orange and Purple wires transmit signals to the module from the distributor stator/magnetic pick-up coil. The Black/Green wire is the distributor ground circuit.

**Distributor** — The distributor contains a pick-up coil which produces a magnetic field. The armature, turning with the distributor shaft, causes the field to collapse. The module senses the make and break of the magnetic field and signals the ignition coil to turn on and off. The distributor cap is large to provide better insulation for the very high secondary voltage.

**Coil** — Coils are oil filled type and each ignition system uses a different coil. The wire terminals are designed so that interchange of the two types of coils is not possible. The "DEC" terminal (Green Wire) connects to the electronic control module. The "BAT" terminal (Red Wire) connects to the ignition switch and to the control module (through the ballast resistor on Dura-Spark II).

**System Protection** — System is protected against electrical currents produced or used by any other vehicle component during normal operation. **NOTE** — Damage to ignition system can occur if proper testing procedures are not followed.

### DURA SPARK SYSTEM PRECAUTIONS

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

A  $\frac{3}{4}$ " 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 about  $\frac{1}{8}$ ". Do not remove this grease if discolored, because the grease will maintain its insulating properties.

When replacing spark plug wires, insure wire made of the same material is used for 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.

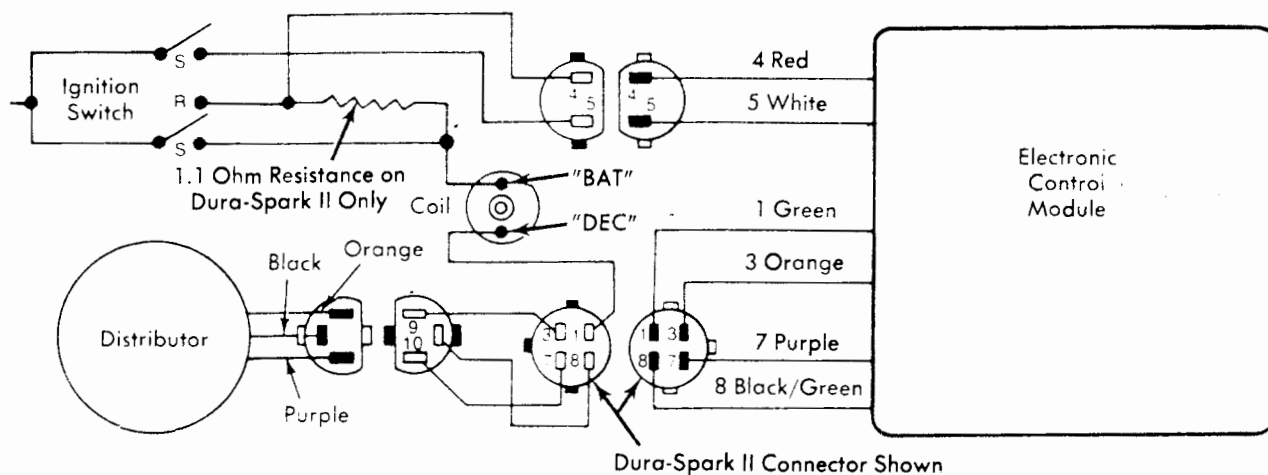


Fig. 1 Dura-Spark I and II Ignition System Wiring Diagram

## MOTORCRAFT DURA-SPARK I & II IGNITION SYSTEMS (Cont.)

### TESTING

#### SECONDARY IGNITION VOLTAGE CHECK

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

- No. 1 or 8 on V-8 engines.
- No. 3 or 5 on inline six cylinder engines.
- No. 1 or 4 on V-6 engines.
- No. 1 or 3 on four cylinder engines.

Perform the following tests using an oscilloscope which has inductive type clamps and following the scope manufacturers' instructions. Also use suitable grounding probes and insulated pliers when called for.

**Secondary Voltage Reserve** 1) Clamp secondary voltage pick-up over distributor-to-coil high voltage wire. Run engine at 1000 RPM and check overall operating condition, then check secondary voltage reserve. Reserve should be 28 Kv minimum. Regardless of reading, continue test.

2) Using an ohmmeter, check resistance of coil-to-distributor high voltage wire. Resistance should be 5,000 Ohms per inch maximum.

**Rotor-to-Cap Voltage Drop** — Make this test with engine at idle and secondary voltage pick-up connected over coil-to-distributor high voltage wire. Drop should not exceed 8,000 volts. If drop is not to specification, check cap and rotor.

**Required Spark Plug Voltage** — Make this test with engine at 2000 RPM with secondary voltage pick-up connected over coil-to-distributor high voltage wire. Firing voltage should be relatively even and between 8-20 Kv. If firing voltage is bad, check individual cylinder firing voltage. Each cylinder should receive a minimum of 6,000 volts and all cylinders should be within 50% of each other.

**Spark Plug Wire Resistance** — Check spark plug wire resistance using an ohmmeter. Resistance should not exceed 5,000 Ohms per inch with spark plug wire connected to the distributor cap and resistance test made through the internal distributor cap terminal.

#### MODULE BIAS TEST

With ignition on, measure voltage at pin 4 (Red wire) to engine ground. If observed voltage is less than battery voltage, repair battery feed wire (Red wire) between ignition switch and control module.

#### BATTERY SOURCE TEST

1) Without disconnecting coil, connect voltmeter between coil "BAT" terminal and engine ground. Connect a jumper wire from coil "DEC" terminal to a good ground. Turn all lights and accessories off and turn ignition on.

2) A voltmeter reading between 4.9-7.9 (Dura-Spark II), or 11-14 (Dura-Spark I) indicates primary circuit from battery to coil is satisfactory.

3) If reading is less than specified, inspect primary wiring (and resistance wire on Dura-Spark II) for worn insulation, broken strands and loose or corroded terminals.

4) If reading is greater than specified on Dura-Spark II, check and replace resistance wire as necessary.

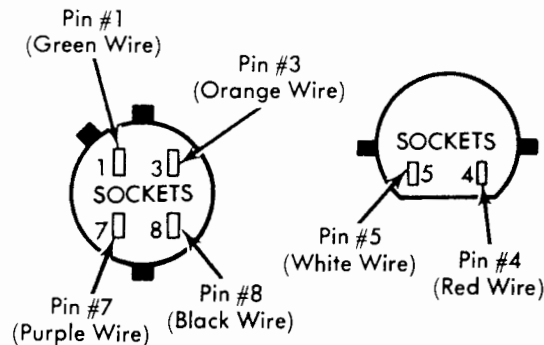


Fig. 2 Dura-Spark I Terminal Connectors on the Engine Harness Near Control Module

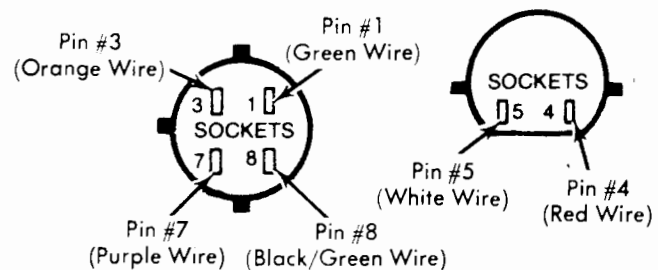


Fig. 3 Dura-Spark II Terminal Connectors on the Engine Harness Near Control Module

#### CRANKING TEST

With engine cranking, measure voltage from pin 5 to engine ground. If voltage is not between 8 and 12 volts, repair voltage feed wire (White wire) to the module.

#### DISTRIBUTOR HARDWARE TEST

Disconnect distributor 2-way pigtail. With voltmeter on 2.5 volts scale and connected between pin 3 and pin 7 and engine cranking, meter needle should oscillate. If meter does not oscillate, remove distributor cap and check for visual damage or incorrect assembly. Armature must be tight on sleeve and roll pin, aligning armature, in position. Iron stator must not be broken and armature must rotate when engine is cranking. If internal components are all good and voltmeter still will not oscillate, replace magnetic pickup (stator assembly).

#### MAGNETIC PICKUP (STATOR ASSEMBLY) TEST

With key off, check resistance between pin 3 and pin 7. Reading should be between 400 and 800 ohms. Check resistance between pin 8 and engine ground to read zero ohms. Check resistance between pin 3 and engine ground, and between pin 7 and engine ground. Both readings should be more than 70,000 ohms. If any of above tests fail, the distributor magnetic pickup is inoperative and must be replaced.

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## MOTORCRAFT DURA-SPARK I & II IGNITION SYSTEMS (Cont.)

### IGNITION COIL TEST

With ignition off, check secondary resistance between pin 4 and coil tower. Resistance should be 7,000-13,000 Ohms. Check primary resistance between pin 1 and pin 4. Resistance should be 1.0-2.0 Ohms (Dura-Spark II), or 0.5-1.5 Ohms (Dura-Spark I). If coil resistance is not within limits, bench test coil using standard coil testing procedures.

### STARTING CIRCUIT TEST

Connect jumper between pin 1 and pin 8. Check voltage between coil "BAT" terminal and ground. **NOTE** — On Dura-Spark I, do not ground coil primary terminal for more than 30 seconds. If reading is less than 6 volts, ignition by-pass circuit is open or grounded. Check all primary circuit connections and wires. Repair or replace parts as required.

### TEST PROCEDURES

VOLTAGE TESTS①	SPECIFICATIONS	CORRECTIONS
<b>With Key On</b> Pin 4 and engine ground	Battery Voltage $\pm 0.1$ volt	Module Bias Test
Pin 1 and engine ground	Battery Voltage $\pm 0.1$ volt	Battery Source Test
<b>While Cranking Engine</b> Pin 5 and engine ground	8 to 12 volts	Cranking Test
Jumper pin 1 to pin 8 Read voltage between coil battery terminal and ground②	More than 6 volts	Starter Current Test
Pin 7 and pin 3	1/2 volt minimum wiggle	Distributor Hardware Test

① — Make tests between Points indicated.

② — On Dura-Spark I, do not allow test to last more than 30 seconds.

RESISTANCE TESTS①	SPECIFICATIONS	CORRECTIONS
<b>With Key Off</b> Pin 7 and Pin 3 Pin 8 and engine ground Pin 3 and engine ground Pin 7 and engine ground	400 to 800 ohms Zero ohms More than 70,000 ohms More than 70,000 ohms	Magnetic Pickup (Stator) Test
Pin 4 and coil tower	7,000 to 13,000 ohms	Ignition Coil Test
Pin 1 and coil battery terminal Dura-Spark II Dura-Spark I	1.0 to 2.0 ohms 0.5 to 1.5 ohms	Ignition Coil Test
Pin 1 and engine ground	More than 4.0 ohms	Short Test
Pin 4 and coil battery terminal (Dura-Spark II Only)	0.7 to 1.7 ohms	Resistance Wire Test

① — Make test between points indicated.

## MOTORCRAFT DURA-SPARK I & II IGNITION SYSTEMS (Cont.)

### SHORT TEST

Check resistance between pin 1 and engine ground. If less than 4 Ohms, check for short-to-ground at coil primary terminals and in primary wiring to coil. Repair as required.

### PRIMARY RESISTANCE WIRE TEST (DURA-SPARK II ONLY)

Resistance between pin 4 and coil battery terminal should be 0.7-1.7 Ohms. If not within specifications, check and/or replace ignition resistance wire.

### SCOPE TESTING SPARK PLUG WIRES

Dura-Spark ignition systems produce electrical patterns which are different from other systems. Use ONLY the "Initial Spike" which represents the required firing voltage. Do not use any other part of the pattern because non-defective parts replacement may result. If a problem appears to exist in the spark

plug wires, remove wire from engine and use an ohmmeter to check the spark plug wire resistance as described earlier in this story.

### OVERHAUL

**Disassembly** — Remove distributor cap and rotor. Disconnect distributor harness plug. Using a small gear puller or two screwdrivers, lift or pry armature from advance plate sleeve and remove roll pin. Remove wire retaining clip, then remove snap ring securing vacuum advance link to pickup assembly. Remove pickup assembly retaining screws and lift assembly from distributor. Lift vacuum advance arm from pickup assembly and position against distributor housing. Remove vacuum advance diaphragm unit. Remove attaching screws and lift base plate assembly from distributor.

**Reassembly** — Reverse disassembly procedure being sure to coat brass surface of rotor with silicone grease.

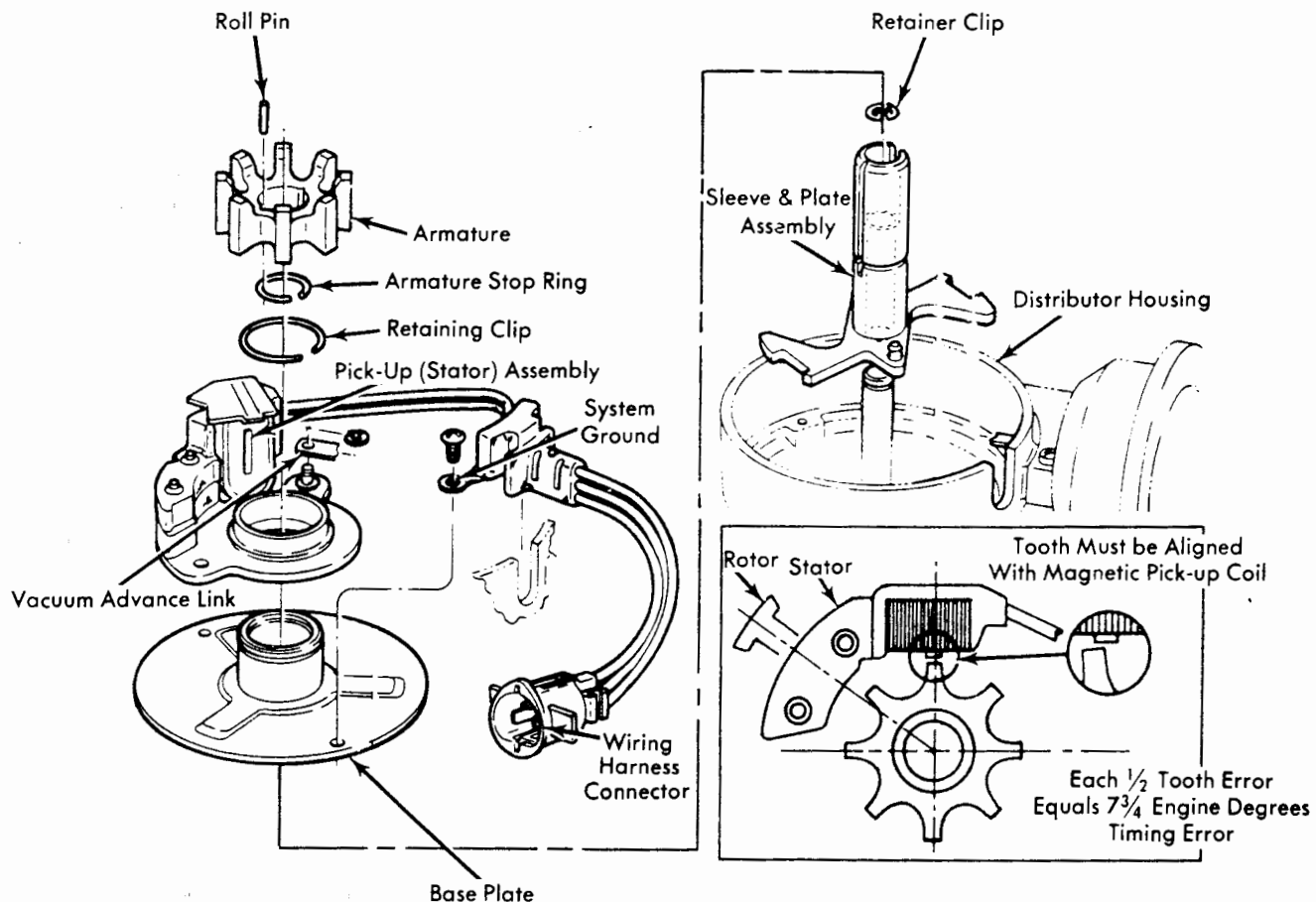


Fig. 4 Exploded View of Dura-Spark Distributor Showing Correct Alignment of Rotor and Magnetic Pick-up Coil Teeth

# 1977 Distributor Specifications

## FORD DISTRIBUTOR ADVANCE SPECIFICATIONS

NOTE — FOR ENGINE RPM AND DEGREES, MULTIPLY SPECIFICATIONS BELOW BY 2.

Distributor Part No. ①	Rot ②	Centrifugal Advance (Distr. Degrees & RPM)						Vacuum Advance (Distr. Deg. & In. of Hg.)			
		Deg.	RPM	Deg.	RPM	Deg.	RPM	Deg.	In. Hg.	Deg.	In. Hg.
D5DE-AFA	CC	0-5	1100	6-9	1340	20-24.8	5000	0-6	5.6	21.5	15.3
D6AE-AA	CC	0-4	1000	14.5-19	3000	23-28	5000	0-2	3	25-30.5	11.5
D6DE-JA	CC	0-7	1000	12.6	1160	32.6-37.6	4400	1-7.5	5	21.5	13
D6UE-CA	CC	0-2	900	15-19	1450	22.5-28	5000	0-2	3.5	21.5-26.5	15
D6UE-DA③	CC										
D7AE-BA	CC	0-2	850	5.5-9.5	1250	22-27	4500	0-2	3.5	22.5-30.5	12
D7AE-CA	CC	0-2	1400	7-12	3200	16.5-21.5	5000	0-2	3	27.5-30.5	11
D7AE-DA	CC	0-2	900	7.5-11.5	1350	22.5-28	5000	0-2	3.2	25.5-30.5	14.5
D7AE-KA③	CC										
D7AE-NA③	CC										
D7AE-PA③	CC										
D7BE-CA③	C										
D7BE-DA	C	0-2	1100	3.5-7.5	1200	11.5-17	5000	0-2	3	17.5-22.5	11
D7BE-EA	C	0-2	1100	9.5-13.5	1250	22.5-27.5	4900	0-2	3	17.5-22.5	13.5
D7BE-FA	C	0-2	1100	2-6	1100	11-16.5	5000	0-2	3	9.5-14.5	6.5
D7BE-GA③	C										
D7DE-CA	CC	0-2	1400	7-12	3200	16.5-21.5	5000	0-2	3	22.5-30.5	11
D7DE-FA	CC	+3 - -2	900	3.5-9	1100	22-27.5	5000	-1	4.5	30	14
D7DE-GA	CC	0-2	1150	4.5-8.5	1400	9-14.5	5000	0-2	3	21.5-26.5	16
D7DE-HA	CC	-2 - +1	1100	4-8	1500	7-13	5000	0-4	5	30	14
D7EE-BA③	C										
D7EE-CA	C	0-2	1600	2-7	3000	10-15	5000	0-1	2.3	21.5-26.5	15.75
D7EE-DA	C	0-2	1020	7.5-11.5	1450	23-28	5000	0-1	1.75	21.5-26.5	12.4
D7EE-EA	C	0-2	1050	7.2-11.2	1450	23-28	5000	0-1	2	21.5-26.5	15.75
D7EE-FA③	C										
D7EE-GA	C	0-2	1050	7.5-11.5	1480	23-28	5000	0-1	2.25	21.5-26.5	15.75
D7EE-HA	C	0-2	1150	2.5-7.4	3000	10-15	5000	0-1	2	21.5-26.5	15.75
D7OE-CA	CC	0-2	900	5.5-9.5	1150	27-32	5000	0-2	3.5	25.5-30.5	14.5
D7OE-DA③	CC										
D7UE-CA③	CC										
D7UE-DA③	CC										
D7ZE-BA	CC	0-2	850	12-16	1300	27-32	5000	0-2	3.5	21.5-26.5	15.2
D7ZE-CA	CC	0-2	1150	12.5-16.5	2500	18.5-24	5000	0-2	2.2	25.5-30.5	16
D7ZE-GA③	CC										
77TF-AA	C	0-2	1250	10-15	2000	16-21	4200	0-2	4.5	16-20	12
77TF-CA	C	0-2	1150	11-15	1500	19-25	5000	0-2	3.5	10-14	8.5
77TF-DA	C	0-2	1200	10-15	1800	10-21	4200	0-2	4	10-14	10

① — Basic part number is 12127.

② — C (Clockwise), CC (Counterclockwise) viewed from rotor end.

③ — Specifications not available from manufacturer at time of publication.

## PRESTOLITE DISTRIBUTOR ADVANCE SPECIFICATIONS

NOTE — FOR ENGINE RPM AND DEGREES, MULTIPLY SPECIFICATIONS BELOW BY 2.

Distributor Part No.	Rot ①	Centrifugal Advance (Distr. Degrees & RPM)						Vacuum Advance (Distr. Deg. & In. of Hg.)			
		Deg.	RPM	Deg.	RPM	Deg.	RPM	Deg.	In. Hg.	Deg.	In. Hg.
IDJ-4001E	C	0	350-550	8	600-850	13	2200	0	4-6	17	11½
IDJ-4001F	C	0	350-550	8	650-1200	9½	2200	0	4-6	17	11½
IDJ-4001G	C	0	350-550	8	600-775	15½	2200	0	5-7	17	13
IDJ-4001H	C	0	350-550	8	500-700	12	2200	0	5-7	17	13
IDJ-4002F	C	0	350-550	8	800-1000	11	2200	0	5-7	18	13

① — C (Clockwise), CC (Counterclockwise) viewed from rotor end.