

CHRYSLER CORP. ELECTRONIC SPARK CONTROL

DESCRIPTION

Electronic Spark Control (ESC) system is governed by a Spark Control Computer, various engine sensors and a specially calibrated carburetor. The function of this system is to provide a method for the engine to burn a lean air/fuel mixture.

NOTE — All California vehicles and Federal 318" 4-Bbl. equipped vehicles have an Electronic Spark Combustion Computer.

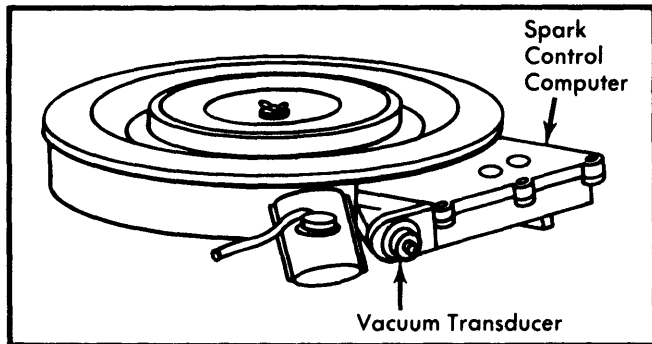


Fig. 1 Electronic Spark Control Computer

SPARK CONTROL COMPUTER

The Spark Control Computer (SCC) is the heart of the entire system. It gives the system the capability of igniting a lean fuel mixture according to different modes of engine operation by delivering an infinite amount of variable advance curves. The computer determines the exact instant when ignition is required, then feeds the ignition coil to produce electrical impulses which fire the spark plugs. There are two slightly different computers depending upon application.

NOTE — Spark Control or Combustion Computers are mounted on air cleaner on 6 cyl. and V8 engines, or on fender apron of vehicles with 4 cyl. engines.

The computer consists of 1 electronic printed circuit board which receives signals from all the sensors and within milliseconds computes them so that proper advance or retard is immediately achieved.

SPARK COMBUSTION COMPUTER

The Combustion Computer controls ignition system and air/fuel ratio of carburetor. Electronic Spark Advance (ESA) system is new in determining spark advance by engine speed and vacuum only. Start timer, vacuum transducer count-up clock and memory, throttle transducer and ambient air temperature sensor are not used. Computer consists of 1 electronic circuit board with a microprocessor that processes signals from all the sensors and within milliseconds computes them so that proper ignition timing and carburetor mixture is immediately achieved. This digital electronic circuitry offers more operating precision and programming flexibility.

SENSORS

Vehicles equipped with Electronic Spark Control Computer use 4 sensors on 4 and 6 cylinder engines, 5 sensors on V8 engines.

The sensors are; pick-up coil assembly (Hall Effect type on 4 cylinder engines), coolant temperature switch, carburetor switch, vacuum transducer and detonation sensor (Calif. V8 engines only).

Vehicles equipped with Electronic Spark Combustion Computer use 8 sensors. The sensors are; pick-up coil assembly (single or dual pick-up), coolant temperature switch, carburetor switch, vacuum transducer, detonation sensor (Calif. V8 engines only), oxygen sensor, speed sensor and charge temperature switch. Functions of sensors are as follows:

Pick-Up Coil — The pick-up coil (called Hall Effect pick-up on 4 cylinder models) is located in the distributor and supplies the basic timing signal to the computer. California and High Altitude 318" V8 and Federal 360" 4-Bbl. V8 use 2 pick-ups, start and run, to provide computer with the basic timing signal.

Coolant Temperature Switch (Oxygen Feedback Only) — Located on thermostat housing (all 4 cyl. engines), on front of cylinder head (all 6 cyl. engines) and on right front of intake manifold (all V8 engines). Sensor signals computer and prevents changing of air/fuel ratio until engine reaches 150° F. When engine reaches 150° F, switch allows computer to change air pump injection point from upstream to downstream and allows charcoal canister to purge itself. V8 engines use 2 different temperature sensors. If equipped with computer part no. 4145003, switch operating temperature is 150° F. If equipped with computer part no. 4145088, switch operating temperature is 98° F.

Detonation Sensor — System is used on all California V8 engines. System uses a sensor mounted in intake manifold. Sensor is tuned to frequency characteristic of engine knocking. When knock frequencies are detected, sensor sends a low voltage signal to computer. Computer will then retard timing a maximum of 11°. Amount of retard is directly proportional to strength and frequency of detonation. When detonation stops, timing is advanced to original position.

Carburetor Switch — Located on right side of carburetor, on end of idle stop on V8 engines. Switch is located on idle stop solenoid or air conditioning solenoid on Omni and Horizon models. Carburetor switch signals computer if engine is at idle or off idle.

Vacuum Transducer — Located on Spark Control or Combustion Computer, it signals the computer what the engine vacuum is at that moment. Engine vacuum is one of the factors that will determine how the computer will advance or retard ignition timing and change air/fuel ratio of carburetor.

Oxygen Sensor — Located in exhaust manifold, it signals the computer how much oxygen is present in the exhaust gases and computer will then adjust air/fuel ratio to level which will maintain operating efficiency of 3-way catalyst system.

Speed Sensor — Pick-up coil assembly functions as speed sensor in system. Amount of ignition advance is determined by computer in relationship to engine RPM.

Charge Temperature Switch — Used on 6 cyl. and V8 engines only. CTS switch is located in No. 6 branch runner of intake manifold on 6 cyl. engines and in No. 8 branch runner of intake manifold on V8 engines. When air/fuel mixture tem-

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perature is below 60°F, switch will be closed, preventing EGR timer and valve operation. When air/fuel mixture temperature is above 60°F, switch will open, allowing EGR timer and valve operation and on V8 engines, change air pump air injection from upstream to downstream in exhaust system.

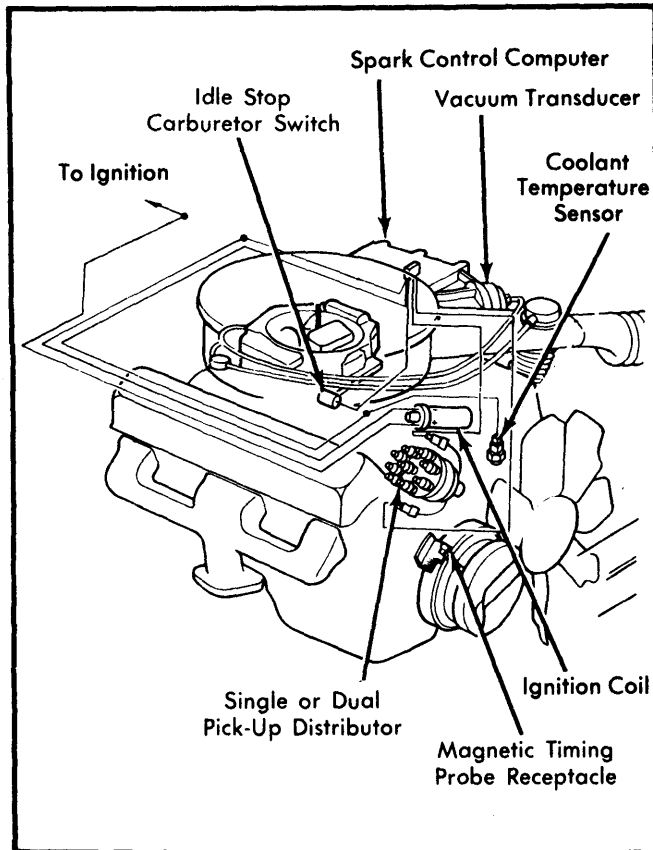


Fig. 2 Electronic Spark Control System (V8 Engines Shown, Others Similar)

OPERATION

The Spark Control Computer functions in 2 modes, "Start" and "Run". During engine cranking, "Start" mode is in operation. A fixed advance (basic timing) is used during this mode. After engine starts, "Run" mode takes over. (The 2 modes never operate at the same time). Now, amount of timing advance is controlled by computer, based upon information received from all engine sensors.

The pick-up coil signal is a reference signal. When received by computer, maximum amount of timing advance is made available. Computer determines how much advance is needed at that instant, based on data from sensors. If for some reason failure of the "Run" mode occurs, the "Start" mode will come back into service and allow vehicle to be driven. If failure of the computer occurs, system will go into "Limp-In" mode. This will allow vehicle to be driven until repairs can be made, however very poor performance and economy will result from either type of failure. If failure of pick-up coil or "Start" mode of computer occurs, engine will not start or run.

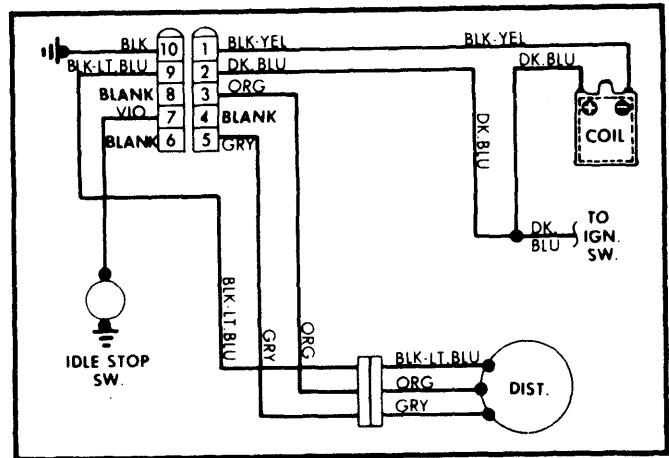


Fig. 3 Electronic Spark Control Wiring Diagram (Omni and Horizon)

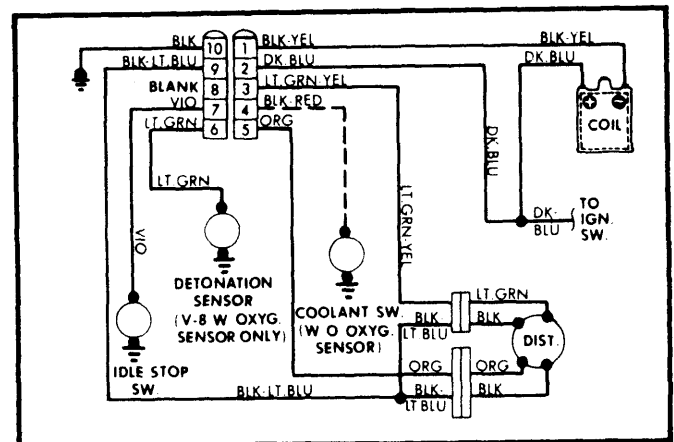


Fig. 4 Electronic Spark Control Wiring Diagram (Exc. Omni and Horizon)

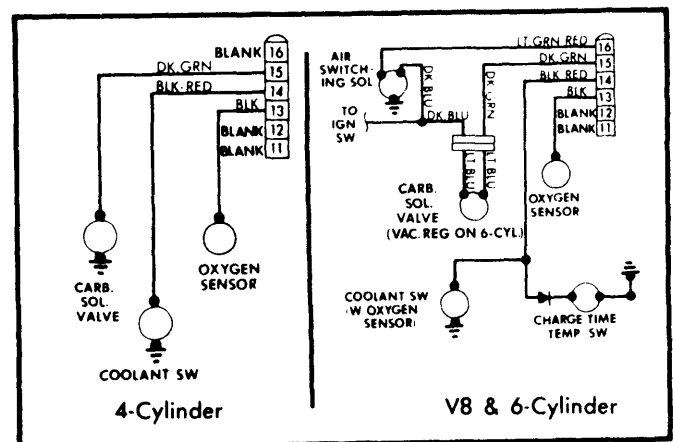


Fig. 5 Spark Combustion Computer Wiring Diagram (When Equipped With Additional 6 Pin Connector)

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TESTING

IGNITION SYSTEM STARTING TEST

- 1) Remove coil wire from distributor cap. Hold end of wire about $\frac{1}{4}$ " away from a good engine ground. Have an assistant crank engine while you look for a spark at the coil wire. If there is a spark, it must be constant and bright blue.
- 2) If the spark is good, continue engine cranking while moving coil wire away from ground and look for arcing at the coil tower (between coil terminals). If arcing occurs, replace coil.
- 3) If spark is weak or not constant, or if there is no spark, proceed to "Failure to Start Test."
- 4) If spark is good and there is no arcing at coil tower, ignition system is producing necessary high secondary voltage. Make sure this spark is getting to plugs by checking distributor rotor, cap, spark plugs, and plug wires.
- 5) If all this checks out okay, but engine still will not start, the ignition system is not the problem. It will be necessary to check fuel system and engine mechanical items.

FAILURE TO START TEST

NOTE — Perform "Ignition System Starting Test" first. Failure to do so may result in lost diagnostic time or incorrect test results.

All Models Except Omni and Horizon — 1) Measure and record battery voltage. Battery specific gravity must be at least 1.220 (temperature-corrected) to deliver proper voltage to cranking (ignition) system.

2) Insert a piece of paper between idle adjusting screw and carburetor sensor, or insure screw does not contact sensor. Connect voltmeter negative lead to ground.

3) Turn ignition to "RUN" position and measure voltage at carburetor switch terminal. If voltage is approximately 5 volts, proceed to step 7).

4) If voltage is less than 5 volts, turn ignition to "OFF" and disconnect the 10 pin connector from computer. Turn ignition to "RUN" and measure voltage at pin "2" of 10 pin connector. Voltage should be within 1 volt of battery voltage.

5) If voltage is correct, proceed to step 7). If voltage is incorrect, check and repair wiring and/or connections between pin "2" and ignition switch.

NOTE — All tests are made through 10 pin connector unless otherwise noted.

6) Turn ignition switch "OFF" and check continuity between pin "7" and carburetor switch terminal. If there is no continuity, check wire between pin "7" and carburetor switch. If continuity exists, check continuity between pin "10" and ground. If continuity exists, replace computer. If there is no continuity, check wire from pin "10" to ground.

NOTE — Proceed with remainder of this test only if engine fails to start.

7) Turn ignition to "RUN" position and connect positive lead of voltmeter to pin "1". Connect negative lead to ground. Voltage should be within 1 volt of battery voltage. If voltage is correct, proceed to step 10). If voltage is incorrect, proceed as follows.

8) Turn ignition "OFF". Measure resistance between pins "5" and "9" for run pick-up coil and between pins "3" and "9" for start pick-up coil (dual pick-up distributors) using an ohmmeter. Resistance should be within 150-900 ohms. If resistance is correct, proceed to step 11). If resistance is incorrect, proceed as follows.

9) Disconnect pick-up coil leads at distributor and measure resistance across pins of distributor connector. Resistance should be 150-900 ohms. If resistance is correct, wires between pins "3", "5", "9" and pick-up coil connector are shorted or broken. If resistance is incorrect, pick-up coil assembly should be replaced.

10) Connect 1 lead of ohmmeter to ground and other lead to each of the pins of the pick-up coil assembly connector (at distributor). No continuity should exist. If continuity exists, pick-up coil is shorted and should be replaced.

11) Remove distributor cap, check air gap of pick-up coil(s). If air gap is incorrect, adjust to specifications. Install distributor cap and reconnect all wiring. Start vehicle, if vehicle fails to start, install new computer.

12) If vehicle now starts, system is functioning properly. If vehicle would not start when new computer was installed, install old computer and repeat test procedures because testing procedure was not performed correctly.

Omni and Horizon Models — 1) Measure and record battery voltage. Battery specific gravity must be at least 1.220 (temperature corrected) to deliver proper voltage to cranking (ignition) system.

2) Disconnect wire from negative terminal of coil. Remove coil secondary wire from distributor cap. Connect jumper wire to coil negative wire.

3) Turn ignition "ON". Using jumper wire, quickly touch negative terminal of coil to ground while holding coil secondary wire $\frac{1}{4}$ " from good engine ground. A spark should be obtained.

4) If no spark, make the following checks:

- Check coil positive terminal voltage; should be at least 9 volts.
- If voltage is correct, coil is defective and should be replaced.
- If voltage is incorrect, check and repair wiring and/or connections as required.
- If vehicle still will not start, proceed to step 5).

5) If spark was obtained, turn ignition "OFF" and reconnect coil. Disconnect 3-wire connector from computer at distributor. Turn ignition "ON" and measure voltage from pin "B" to engine ground. Voltage should be battery voltage. See Fig. 6.

6) If voltage was correct, proceed to step 9). If voltage was incorrect, turn ignition "OFF" and disconnect 10 pin connector at computer.

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NOTE — All tests are made through 10 pin connector at computer and 3 pin connector at distributor unless otherwise noted.

7) Check continuity between pin "3" and pin "B". If no continuity exists, repair wiring and/or connections. If continuity exists, proceed to step 8).

NOTE — There must be at least 1/4" layer of multi-purpose grease on 10-wire connector and connector cavity. Do not remove grease. Reapply if necessary.

8) Turn ignition "ON", check for battery voltage between pins "2" and "10". If voltage is same as battery voltage, spark control computer is defective and should be replaced. If voltage is not same as battery voltage, check and repair wiring and/or connections.

9) Reconnect 10 pin connector to computer. Hold coil secondary wire 1/4" from ground and turn ignition "ON". Use jumper wire to momentarily touch pins "A" and "C" together and check the following:

- If coil wire sparks, Hall Effect pick-up coil assembly is defective.
- If coil wire does not spark, proceed to step 10).

10) Turn ignition "OFF", disconnect 10 pin connector from computer. Using ohmmeter, check continuity as follows:

- Pin "C" to pin "9".
- Pin "A" to pin "5".
- If continuity exists with these checks, spark control computer is defective and should be replaced.
- If continuity does not exist, wiring and/or connections are shorted or broken, repair as required.
- After repairs are made, go back and repeat step 8).

POOR PERFORMANCE TESTS

NOTE — Be sure basic timing and curb idle are set before beginning the following tests.

Start-Up Advance Timing Test — 1) Connect an adjustable timing light or timing probe to engine. Use jumper wire to ground carburetor switch. Make sure vacuum hose is connected to vacuum transducer on computer.

2) Start engine and immediately check timing and adjust timing light so timing marks are set at basic timing. Meter on timing light should show start-up advance timing. Refer to Distributor Specifications in this Section. If timing is not as specified, replace computer.

Speed Advance Test — 1) Disconnect jumper wire from carburetor switch to ground. Start and run engine for 2 minutes. Raise RPM to specifications. Adjust timing light so basic timing is seen at timing indicator.

2) Additional advance seen on timing light meter should be as specified. If not, replace computer and repeat test. If within specifications, proceed to next test.

POOR FUEL ECONOMY AND UNUSUALLY HIGH IDLE SPEED TESTS

Vacuum Advance Schedule Test — 1) While proceeding through following test, be sure to check each specification when indicated. See appropriate table in DISTRIBUTOR SPECIFICATIONS section of this manual.

CAUTION — Use of a rubber exhaust tube for ventilation may result in fire due to high temperatures experienced during this test. Only use a metal exhaust tube.

2) Connect magnetic timing probe or adjustable timing light and tachometer to engine. Start engine and warm to normal operating temperature. If already at operating temperature, wait at least 1 minute for Start Up Advance to return to basic timing. Put transmission in Neutral and apply parking brake. Perform the following steps and check in order:

- If necessary, check and adjust basic timing. Remove and plug vacuum hose at vacuum transducer.
- Disconnect carburetor switch from ground connection. Increase engine speed to 1100 RPM.
- Check "Speed Advance Timing", timing should be as specified in Distributor Specifications.
- With engine at 1100 RPM, connect vacuum hose to vacuum transducer. Allow accumulator in computer to

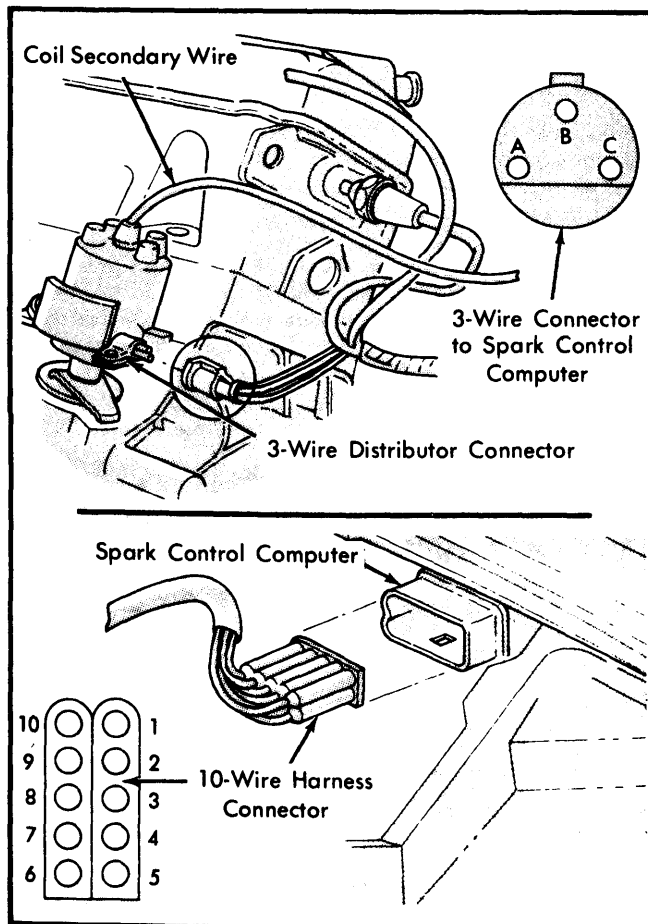


Fig. 6 Disconnecting Wiring Harnesses for Tests (Pin Locations Shown)

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clock up. Refer to Distributor Specifications for correct clock up time.

- With accumulator clocked up and engine still at 1100 RPM, check "Vacuum Advance", it should be as specified in Distributor Specifications.
- Disconnect and plug vacuum hose at transducer and run engine at 1500 RPM (3000 RPM for 4 cyl. engines).
- Note "Speed Advance Timing". Connect vacuum hose to vacuum transducer.
- Check "Vacuum Advance", it should be as specified in Distributor Specifications. Return engine to curb idle, connect carburetor switch to ground.

DETONATION SENSOR TEST

NOTE — Detonation sensor is used on Calif. V8 engines only.

- 1) Connect variable timing light or timing probe to engine. Start engine and run on second highest step of fast idle cam (minimum 1200 RPM). Tap lightly on intake manifold near sensor using suitable metal object.
- 2) Using timing light or timing probe, look for decrease in timing (maximum 11°). Decrease will be directly proportional to strength and frequency of tapping.
- 3) If sensor fails to perform as specified, replace and repeat test. If new sensor fails to perform as specified, check wiring back to computer.

ESC VACUUM TRANSDUCER TEST

- 1) Connect an adjustable timing light or timing probe and tachometer to engine. Start engine and warm to operating temperature. Remove and plug hose at vacuum transducer.
- 2) Connect suitable vacuum pump to vacuum transducer and apply 14 in. Hg vacuum. Raise engine speed to 2000 RPM, wait 1 minute and check timing. Advance specifications should be as specified and are in addition to basic timing. Refer to Distributor Specifications in this section.
- 3) Return engine to curb idle. Turn engine off, remove all test equipment and reconnect vacuum hose to vacuum transducer.

COMBUSTION COMPUTER TEST

- 1) Connect tachometer to engine. Start engine and warm to operating temperature. Disconnect coolant temperature switch and CTS switch (if equipped). DO NOT ground carburetor switch.
- 2) Set engine speed at 1200 RPM. Disconnect oxygen sensor connector at sensor and connect jumper wire from connector end to ground.
- 3) An increase in engine speed should be observed (minimum of 50 RPM) for 15 seconds, then return to 1200 RPM. If engine speed does not change, disconnect 4-way "T" at temperature sensor on air cleaner, allowing engine to draw in air.
- 4) Repeat test again, if engine speed still fails to change, replace computer. Reconnect 4-way "T". Disconnect jumper wire from ground and connect to battery voltage, engine speed should decrease (minimum of 50 RPM).

- 5) If computer fails any of these tests, replace computer. Reconnect wires, return engine to curb idle. Stop engine and remove all test equipment.

COOLANT SENSOR/SWITCH TEST

- 1) Disconnect coolant sensor/switch connector. Connect one lead of ohmmeter to sensor/switch terminal and other lead to ground.
- 2) With engine temperature below sensor/switch operating temperature, resistance should be less than 10 ohms. With engine temperature above sensor/switch operating temperature, resistance should be infinite.

ADJUSTMENTS

PICK-UP COIL — AIR GAPS

NOTE — Air gap is not adjustable on the Hall Effect pick-up used on 4-cyl. engines.

Single Pick-Up Coil — 1) Loosen pick-up coil hold down screw and align 1 reluctor blade with pick-up pole being checked. Set air gap using a .006" non-magnetic feeler gauge.

- 2) Tighten hold down screw. Check gap with a non-magnetic feeler gauge .002" larger than setting gauge.

NOTE — On all distributors, DO NOT force larger feeler gauge into air gap when checking.

Dual Pick-Up Coils — 1) Loosen pick-up coil hold down screws and align 1 reluctor blade with the "Start" pick-up pole. Set air gap using a .006" non-magnetic feeler gauge. Tighten hold down screw.

- 2) Align 1 reluctor blade with the "Run" pick-up pole. Set air gap using a .012" non-magnetic feeler gauge. Tighten hold down screw. Check gaps with a non-magnetic feeler gauge .002" larger than setting gauge. Gauge should not fit between reluctor tooth and pick-up pole.

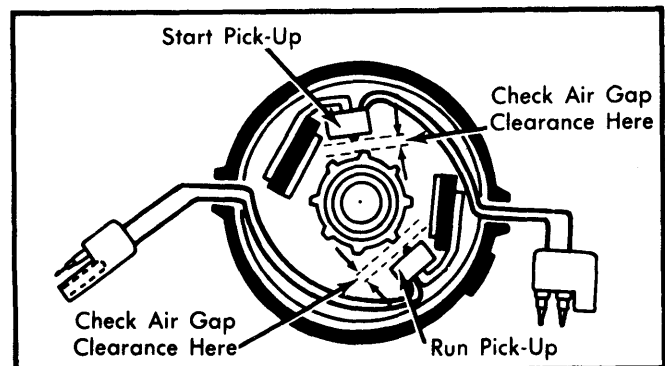


Fig. 7 Pick-Up Coil Air Gap Adjustment (Dual Pick-Up Shown, Single Pick-Up Similar)

SPECIFICATIONS

NOTE — For Chrysler Corp. Electronic Spark Control Computer and Distributor specifications refer to appropriate tables in DISTRIBUTOR SPECIFICATIONS Section.