CHRYSLER CORP. ELECTRONIC SPARK CONTROL SYSTEM

Chrysler Corp.
3.7L (225") 6-Cylinder
Calif. Only
5.2L (318") V8

DESCRIPTION

The Electronic Spark Control (ESC) system is governed by a Spark Control Computer, 7 engine sensors, a specially-calibrated carburetor and, on most models, a dual pick-up distributor. V8 models with electronic fuel injection (318" EFI) have a single pick-up distributor. The ESC system is designed to burn a lean air/fuel mixture, with a minimum of emissions. See *Fig. 1*.

NOTE – *For a diagram of 10-wire and 12-wire connectors for the ignition and electronic fuel injection systems of 318" V8 EFI, see Chrysler Electronic Fuel Injection Articles in Fuel Systems Section.*

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 signals the ignition coil to produce the spark required to fire the spark plugs.

The computer consists of one 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.

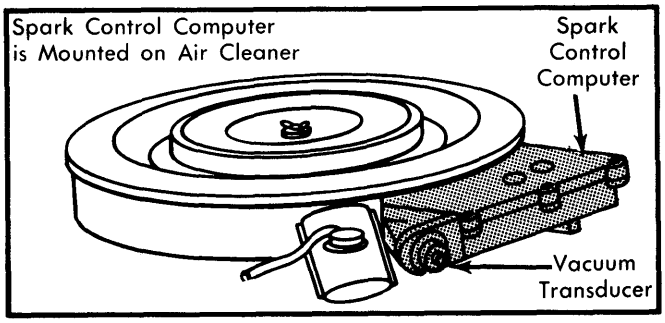

Fig. 2 Electronic Spark Control Computer

SENSORS

The electronic spark control computer, mounted on the air cleaner, uses 7 engine sensors to determine when to fire the spark plugs. See *Fig. 2*. These include the distributor pick-up coil(s), coolant temperature sensor, carburetor switch, vacuum transducer, detonation sensor, oxygen sensor and charge temperature switch. Their functions are as follows:

Magnetic Pick-Up Assembly – The pick-up coil assembly is located in the distributor. The start pick-up coil supplies a signal to the computer, which will cause the spark plugs to fire at a fixed amount of advance during cranking only. Once the engine begins to run, the run pick-up coil takes over, supplying advance information to the computer. The computer then modifies advance information to reflect other engine operating conditions supplied by the remaining sensors. The 318" V8 engine with electronic fuel injection has only one pick-up coil.

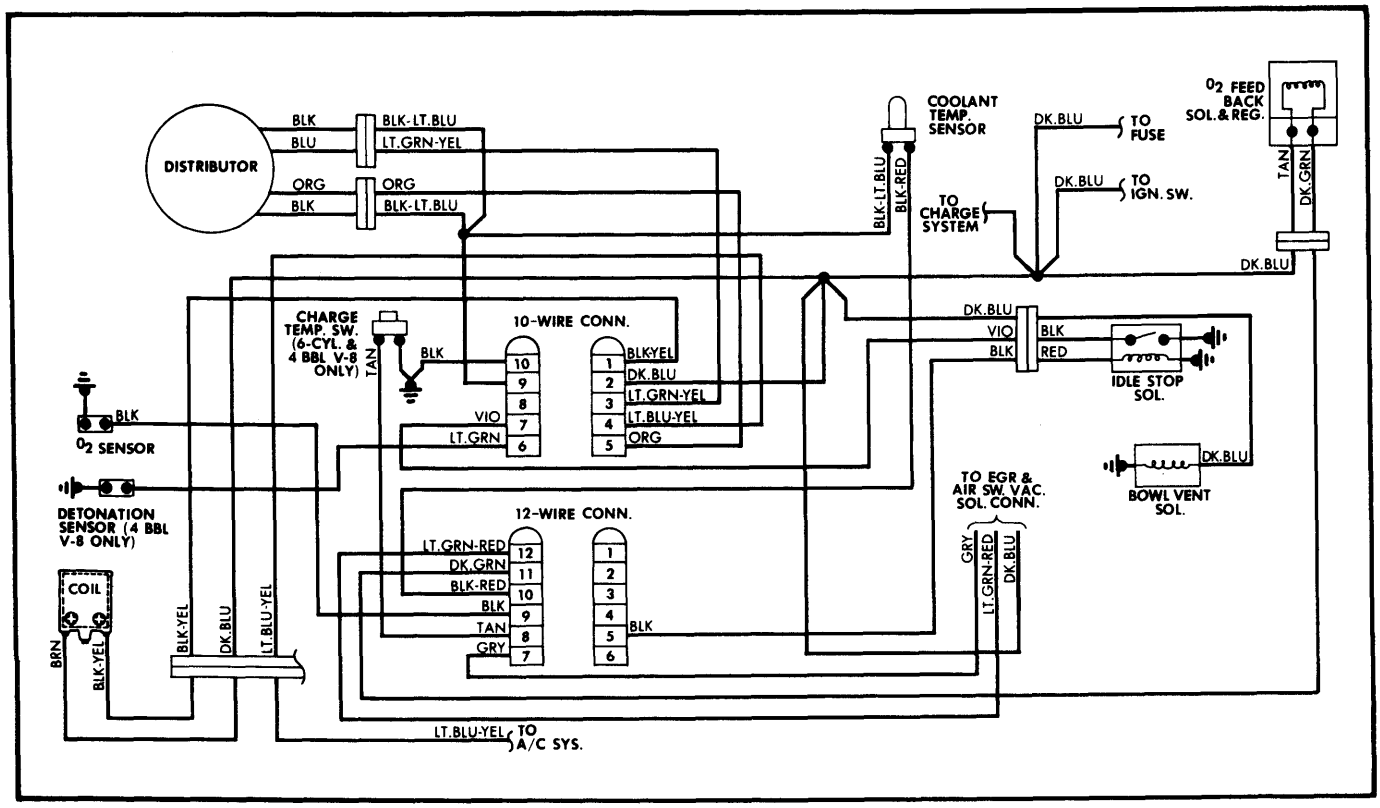

Fig. 1 Wiring Diagram for Chrysler Corp. Electronic Spark Control System (Rear Wheel Drive Vehicles with V8 or 6-Cylinder Engines)

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Coolant Temperature Sensor – The coolant sensor is located in the cylinder head of 6-cylinder engines and in the intake manifold of most V8 engines. The 318" 2-barrel engine has the coolant temperature switch in the charge temperature switch location on the intake manifold. The coolant sensor informs the computer when the engine has reached a predetermined temperature, so that proper adjustment can be made in the air/fuel ratio. It also prevents changes until such temperature is reached.

Vacuum Transducer – This sensor, located on the spark control computer, signals the computer to inform it of engine operating vacuum. Vacuum is one of the factors used to determine whether the computer will advance or retard ignition timing or change the air/fuel ratio.

Carburetor Switch – Located on the end of idle stop, the carburetor switch informs the computer when the engine is at idle. When carburetor switch contacts throttle lever ground, the computer will cancel spark advance and prevent air/fuel ratio from being adjusted.

Detonation Sensor – Used only on 318" 4-Barrel V8 engines, this sensor is mounted in the intake manifold and sends a low voltage signal to the computer whenever engine knock is detected. The computer then retards timing a maximum of 11°, the actual amount being in proportion to the strength and frequency of the detonation. When the condition no longer exists, timing is advanced to its original value.

Oxygen Sensor – Located in the exhaust manifold, this sensor informs the computer of the amount of oxygen present in exhaust gases. The amount is proportional to the rich and lean mixtures. The computer adjusts air/fuel ratio so that it will maintain operating efficiency of the 3-way catalyst system and the engine.

Charge Temperature Switch – This sensor is located in the intake manifold. The switch will be closed when intake charge (air/fuel mixture) is below 60°F. This permits no EGR timer function, no EGR valve operation and switches air injection upstream into exhaust system. When temperature is above 60°F, the switch opens, allowing EGR timer to time out, the EGR valve to operate and air injection is switched downstream into the exhaust system.

OPERATION

The Spark Control Computer has two functional modes, "Start" and "Run". The "Start" mode operates while cranking and starting only. The "Run" mode operates after engine has started and during normal engine operation. The two modes never operate at the same time. When cranking and starting the pick-up coil sends a signal to the computer which is in the "Start" mode, the "Run" mode is by-passed. During this time a fixed advance is used. Advance is determined by distributor position (basic timing). After engine starts, the pick-up coil continues to send a signal to the computer, but the computer is now in the "Run" mode and "Start" mode is by-passed. The amount of timing advance is now controlled by the computer, based upon information received from the engine sensors.

The amount of spark advance is determined by two factors, engine speed and engine vacuum. At what point it occurs depends upon computer programming. Advance from vacuum will be provided when carburetor switch is open. The amount is programmed into the computer and is proportional to the amount of vacuum and engine RPM. Advance from speed will be given by the computer when the carburetor switch is open and is programmed to engine RPM.

If for some reason, there is a failure of the "Run" mode of the computer, the "Start" mode will come back into service and allow the vehicle to be driven. Performance and economy will be greatly reduced because of the fixed timing.

TESTING

IGNITION SYSTEM STARTING TEST

1) Turn ignition switch "ON". Remove coil wire from distributor cap. Hold end of wire ¼" from a good engine ground. Intermittently jump coil negative terminal to ground, while watching for spark at coil wire. If there is a spark, it must be constant and bright blue.

2) If spark is good, continue to intermittently jumper coil negative terminal to ground, while slowly moving coil wire away from ground. Check for arcing at coil tower. If arcing occurs, replace ignition 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.*

1) Measure and record battery voltage. Measure specific gravity, which must be at least 1.220 (temperature corrected) to deliver proper voltage.

2) Turn ignition switch "OFF", and disconnect 10-wire connector from spark control computer. Repeat Ignition System Starting Test, step **1)**. If spark results, replace spark control computer.

3) If no spark is obtained, check voltage at coil positive terminal. With ignition switch "ON", connect positive voltmeter lead to coil positive terminal and negative lead to a good ground. Reading should be within 1 volt of battery voltage. If not, check wiring between battery and coil positive terminal.

4) If voltage at positive coil terminal was correct, connect positive voltmeter lead to coil negative terminal and negative lead to a good ground. Again, voltage should be within 1 volt of battery voltage. If not, replace ignition coil.

NOTE – *You may wish to check coil primary and secondary resistance before replacing ignition coil. However, if you have battery voltage on positive side, but not on negative side of coil, ignition coil normally requires replacement.*

5) If voltage was correct at negative coil terminal, but no spark resulted in Ignition System Starting Test, step **1)**, replace ignition coil.

6) If spark results, but engine will not start, turn ignition switch to the "RUN" position. Connect positive voltmeter lead to terminal 1 of 10-wire connector and negative lead to a good ground. See *Fig. 3*. Reading should be within 1 volt of battery voltage. If not, check wire for open and repair it, repeating this step **6)** once more. Reconnect 10-wire connector to computer.

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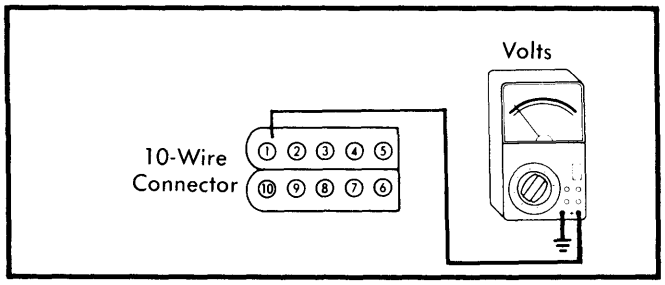

Fig. 3 Voltmeter Hookup for Checking Terminal 1 Voltage

7) If battery voltage was recorded in step **6)**, place a thin insulator (piece of paper) between curb idle adusting screw and carburetor switch or make sure screw does not touch switch. See *Fig. 4*. Connect negative lead of voltmeter to a good ground. Turn ignition switch to "RUN" position, and touch positive voltmeter lead to carburetor switch terminal. Reading should be approximately 5 volts. If so, proceed to step **10)**.

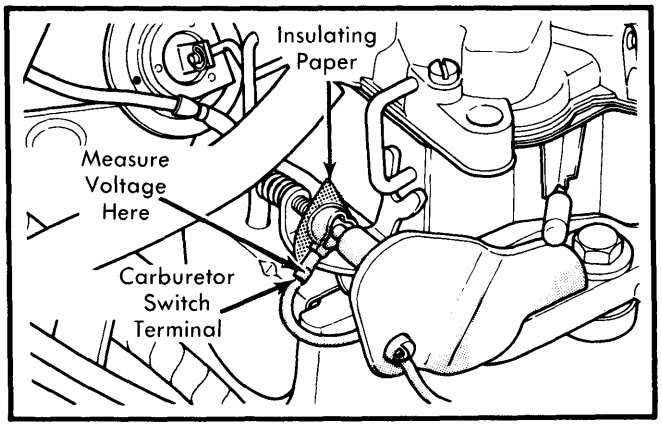

Fig. 4 Checking Voltage at Carburetor Switch

8) If voltage was not at least 5 volts, turn ignition switch "OFF". Disconnect 10-wire connector from computer. Turn ignition switch back to "RUN" position. Connect positive voltmeter lead to terminal 2 of 10-wire connector and negative lead to ground. See *Fig. 5*. Voltage reading should again be within 1 volt of battery voltage. If not correct, check wiring between terminal 2 and ignition switch for opens, shorts or poor connections.

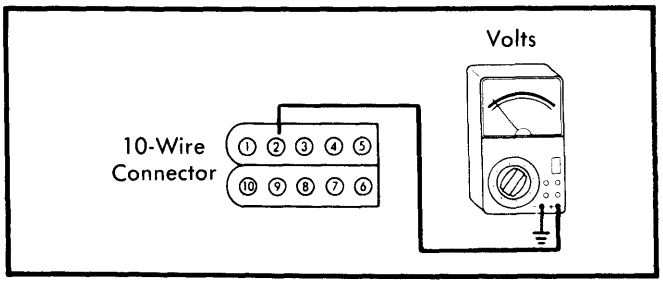

Fig. 5 Voltmeter Hookup for Checking Terminal 2 Voltage

9) If voltage at terminal 2 was correct, turn ignition switch "OFF". Using an ohmmeter, check continuity between terminal 7 of 10-wire connector and carburetor switch terminal. See *Fig. 6*. Continuity should exist. If not, check wire between connections for opens, shorts or poor connections. If continuity is present, use an ohmmeter with leads attached to terminal 10 and engine ground to check continuity of ground circuit. See *Fig. 7*. If there is continuity, replace computer. If there is no continuity, check wire from terminal 10 to ground. If engine fails to start, proceed to next step.

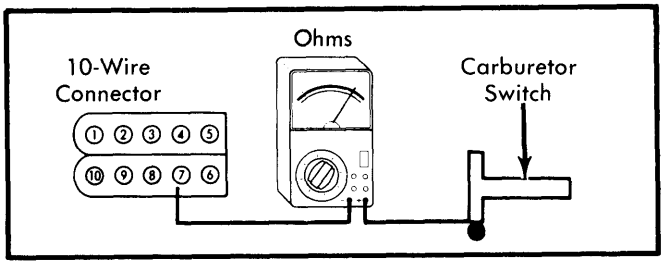

Fig. 6 Ohmmeter Hookup for Checking Carburetor Switch Wiring Harness

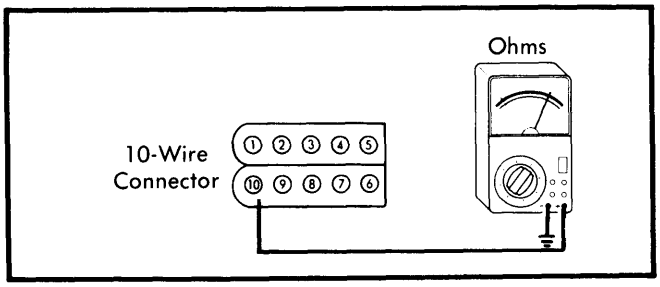

Fig. 7 Ohmmeter Hookup for Checking Computer Ground Circuit

10) Turn ignition switch "OFF". Attach ohmmeter leads to terminals 5 and 9 of 10-wire harness connector to check run pick-up coil resistance and to terminals 3 and 9 to check start pick-up coil resistance. See *Fig. 8*. Resistance should be 150-900 ohms. If so, proceed to step **12)**.

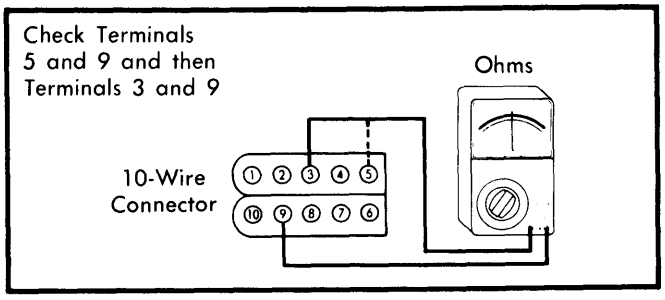

Fig. 8 Ohmmeter Hookup for Checking Pick-Up Coil Resistance

11) If not, disconnect distributor connectors, and attach ohmmeter leads to run pick-up coil leads and then to start pick-up coil leads coming from distributor. If resistance is now okay, wiring harness is defective. If resistance is still not 150-900 ohms, replace pick-up coils, as necessary.

12) Next, connect one lead of an ohmmeter to engine ground and touch other lead to each terminal of leads coming from 2 distributor pick-up coils. There should be no continuity. If continuity is indicated, replace pick-up coil.

13) Remove distributor cap and check each reluctor-to-pick-up coil air gap for .006" clearance. If not to specification, adjust gap, using a non-magnetic feeler gauge. See *Fig. 9*.

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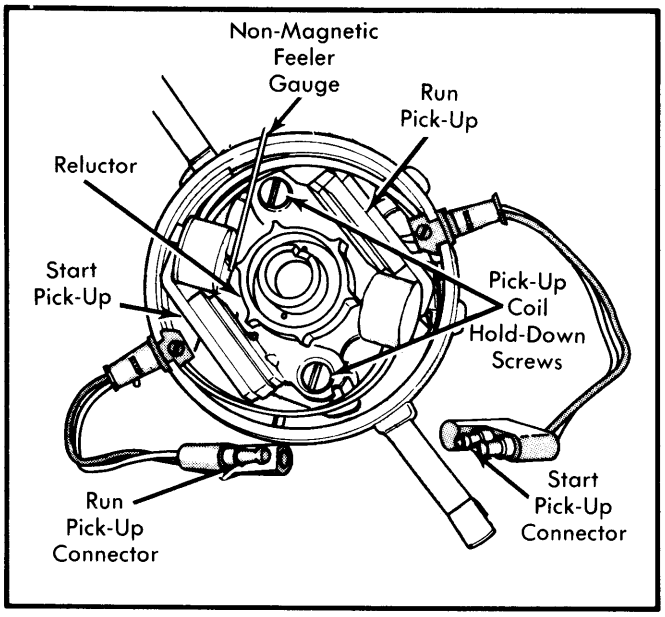

Fig. 9 Checking Distributor Pick-Up Air Gap

NOTE – *To adjust gap, loosen pick-up coil hold-down screws, move pick-up coil against feeler gauge resting against reluctor tooth. Tighten hold-down screw, remove feeler gauge, and recheck gap.*

14) Install distributor cap and reinstall all wiring. If engine fails to start, replace spark control computer. If it still fails to start, install original computer and retest.

IGNITION COIL RESISTANCE CHECKS

1) If ignition coil is suspected, connect ohmmeter leads to positive and negative primary terminals. Ignition switch should be "OFF" and coil wires removed. Primary resistance should read 1.60-1.79 ohms for Prestolite coils; 1.34 to 1.55 ohms for Essex coils.

2) Then move ohmmeter leads to coil negative terminal and coil tower. Ohmmeter resistance reading should be 9,400-11,700 for Prestolite coils, 9,000-12,200 ohms for Essex coils.

3) Replace ignition coil if either specification is not obtained.

POOR PERFORMANCE TESTS

Basic Advance Timing Test – 1) Connect an adjustable timing light to engine so that total timing advance at crankshaft can be checked. Connect a jumper wire between carburetor switch and a good ground.

2) Be sure vacuum line is connected to vacuum transducer on computer. Observe timing mark immediately after engine starts to run, and adjust timing light so basic timing signal is seen at timing plate.

3) The meter on timing light should then show amount of advance, as indicated on vehicle emission control label.

Spark Advance of Computer – 1) Start engine and allow it to warm to normal operating temperature. Put transmission in neutral and set parking brake.

NOTE – *The Spark Control Computer has various spark advance schedules incorporated into its microprocessor for operation at differing engine temperatures. Therefore, be sure engine is at normal operating temperature before testing.*

2) Place a thin insulator (piece of paper) between curb idle adjusting screw and carburetor switch, or make sure screw is not touching switch. *See Fig. 4.* Remove and plug vacuum line at vacuum transducer.

3) Connect an auxiliary vacuum supply to vacuum transducer and set for 16 in. Hg vacuum. Increase engine speed to 2000 RPM, wait one minute for specified accumulator clock up time, and then check specifications. Advance specifications are in addition to basic advance.

CAUTION – *Use a metal exhaust tube for this test, as high temperatures could cause rubber hose to catch fire.*

4) If computer fails to obtain specified settings, replace computer.

CARBURETOR SWITCH TEST

1) Grounding the carburetor switch eliminates all spark advance. Turn key off and disconnect 10-wire harness connector from computer. With throttle completely closed, check continuity between terminal 7 and a good ground. If no continuity is indicated, check wire and carburetor switch. Recheck basic timing.

2) With throttle opened, check continuity between terminal 7 and a good ground. There should be no continuity.

COOLANT TEMPERATURE SENSOR TEST

1) Connect ohmmeter leads to sensor terminals. With engine cold and ambient temperature below 90°F, resistance should be 500-1000 ohms. With engine hot (normal), the resistance should be more than 1300 ohms.

2) If not to specifications, replace sensor. The sensor will continually change its resistance with changes in engine operating temperature.

CHARGE TEMPERATURE & COOLANT SWITCH

1) Turn ignition switch "OFF" and disconnect wire from charge temperature switch. Connect one lead of ohmmeter to a good engine ground (or to switch's ground terminal). Connect other lead to center terminal of coolant switch. Check for continuity.

2) For a cold engine, continuity should be present (resistance less than 100 ohms). If not, replace the switch. The charge temperature switch must be cooler than 60°F to obtain this reading.

3) For an engine at normal operating temperature, the terminal should show no continuity. If it does, replace coolant switch.

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DETONATION SENSOR TEST

NOTE – *This test applies to 318" 4-barrel V8 engine only.*

1) Connect a variable timing light to engine. Start engine and run it on second highest step of fast idle cam (about 1200 RPM). Connect an auxiliary vacuum supply of 16 in. Hg vacuum.

2) Tap lightly on the manifold near the sensor, using a small end wrench. Using the timing light, look for a decrease in spark advance. The amount of decrease in timing should be in proportion to the strength and frequency of the tapping. Maximum decrease in timing would be 11°. Shut off engine and disconnect timing light.

OVERHAUL

NOTE – *The following disassembly and assembly information is for V8 engines with dual pick-up coils. A similar procedure is followed for other models.*

Disassembly – 1) Remove distributor cap. Using 2 screwdrivers, pry off rotor from shaft. Remove reluctor by prying up from bottom of reluctor using 2 pry bars or screwdrivers with a maximum width of 7/16". Be careful not to distort or damage reluctor teeth.

2) Remove 2 screws and lock washers attaching plate to housing, and lift out plate and pick-up coils as an assembly. Do not attempt to remove distributor cap clamps, as they are peened in place.

3) If distributor has excessive shaft side play (more than .006"), replace housing shaft and reluctor sleeve by removing shaft retaining pin and sliding retainer off end of shaft.

4) Use a file to clean burrs from around pin hole in shaft and remove lower thrust washer. Push shaft up and remove shaft through top of distributor housing.

Reassembly – To assemble, reverse disassembly procedure.

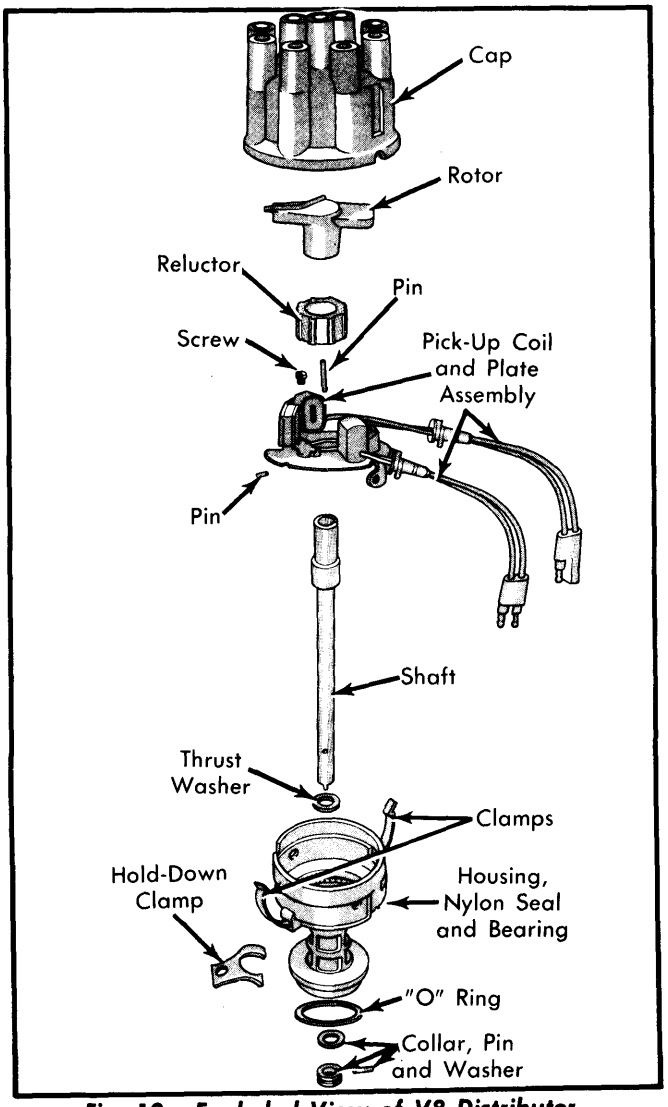

Fig. 10 Exploded View of V8 Distributor for Chrysler Corp. Vehicles