2) Distributor towers
3) Distributor cap
4) Distributor rotor
5) Plug wires (Replace as necessary if a, b, c, and d check OK.)

D. Hookup Procedure (Integral Coil Systems):
Figure 2-2 shows a hookup procedure for most of the leads for the Sears 21045 Analyzer. Only the test leads listed below are required for the SECONDARY INSULATION TEST although the other leads may remain connected.

1. Insert the BLACK 3 pin POWER/POINTS/DWELL/C-3 (11) connector in the 3 pin BLACK socket on the Analyzer. Connect the RED clip to the Positive (+) battery terminal. Connect the BLACK clip to a secure ground connection on the engine, frame, or alternator bracket. The BLACK clip should be the last connection made and the first to be disconnected. (The GREEN clip is not used for this test.)

WARNING

Avoid connecting the BLACK POWER clip directly to the battery Negative (-) terminal in the event that hydrogen gases are present which could explode from sparking connections.

2. Insert the BLUE RPM (13) connector into the BLUE socket of the Analyzer. Clamp the RPM pickup around the No. 1 spark plug wire. The clamp must completely enclose the spark plug wire. See Figure 7-2.
3. Insert the YELLOW KV (12) connector into the YELLOW socket on the Analyzer. Clamp the KV pickup to any spark plug wire except the No. 1 spark plug wire. The clamp must close completely around the wire.
4. Set the ANALOG FUNCTION SELECTOR (4) to RPM.
5. Set the ANALOG RANGE SELECTOR (3) to Low (1200 RPM).

E. Test Procedure (Integral Coil Systems):

1. Start the engine and operate it at curb idle until it is fully warm (upper radiator hose hot).
2. Set the ANALOG FUNCTION SELECTOR (4) to KV and the ANALOG RANGE SELECTOR (3) to the High (60 KV) position.
3. Use a pair of insulated ignition wire pliers to remove the plug wire enclosed in the KV pickup. **The KV pickup must be transferred to each plug wire before it is pulled.** Remove the selected plug wire at the spark plug end. Do not remove the No. 1 spark plug wire. Do not leave a plug wire disconnected for more than a few seconds at a time on a catalytic converter equipped vehicle (overheating of the converter may occur and possibly damage it). For proper test results, do NOT allow the removed plug wire to arc to ground.

WARNING

Do not let sparks occur near the carburetor or other fuel system components as a spark could ignite the gasoline vapors and cause a fire or explosion.

Move plug wires as little as possible out of normal operating position. Check for arcing which may indicate insulation breakdown.

4. Record the readings as shown on the 60KV scale of the ANALOG METER (1) with the plug wire disconnected. See Figure 8-33.
5. Re-install the pulled plug wire. Move the KV pickup to the next plug wire. Repeat Steps 3 and 4 for each plug wire except the No. 1 plug wire.
6. After all plug wires have been tested, move the RPM pickup to any plug wire and close it completely. Clamp the KV pickup to the No. 1 spark plug wire and close it completely. Repeat Steps 3 and 4 for the No. 1 plug wire. Re-install the No. 1 plug wire.

F. Test Results (Integral Coil Systems):

1. Normal
   a. All readings are approximately 20 KV or higher.
   b. No obvious insulation breakdown (no sparking along plug wires, connectors, boots, etc.) is visible.
2. Abnormal
   The abnormal test results listed below will direct you to the most likely problem areas. These test results may indicate a defect in the vehicle. Consult your vehicle service manual for the proper procedures to check these problem areas.
   a. One or more readings are significantly below 20 KV.
   b. Obvious sparking along plug wires, connectors, boots, etc.
   c. Cracks or carbon tracking of the:
      1) Distributor towers
      2) Distributor cap
      3) Distributor rotor
      4) Plug wires (Replace as necessary if 1, 2 and 3 check OK.)

CHAPTER 9
FUEL SYSTEM TESTS AND ADJUSTMENTS

9-1. DESCRIPTION. For any engine to run efficiently, the fuel delivery system (carburetor or fuel injection system) must be functioning properly. An incorrect air/fuel mixture, whether it is too lean or too rich, can cause a variety of engine problems. The procedures that follow discuss some of the more common adjustments that can be made on the fuel system. Because of the increasing complexity of the modern vehicle, it is recommended that the vehicle emission control label and the vehicle service manual be consulted for exact adjustment procedures.

Section 1. Mechanically Controlled Carburetors.

9-2. Mixture Adjustment: Pre-1980 ½. Most mechanically controlled carburetors are adjusted using one of two methods: 1) *the lean drop method* or 2) *the propane enriched method.* Your Sears 21045 Analyzer is a necessary tool for the proper mixture adjustment in either case. Each method will be basically described below; however, it is strongly recommended that you consult the vehicle emission control label and the vehicle service manual for the preferred method and exact instructions. Proper air/fuel mixture is critical to fuel economy, emission control, and drivability. Incorrect adjustment of the carburetor can result in serious problems in these areas.

NOTE

This procedure is not recommended unless there is reason to believe the carburetor has been tampered with or emissions, fuel economy, and drivability tests have shown the need for it. If the mixture adjustment limiter caps (when equipped) are in place and appear undisturbed, it is recommended that they be left alone.

A. HOOKUP PROCEDURE (BOTH METHODS):

Figure 2-2 shows a hookup procedure for most of the leads on the Sears 21045 Analyzer. Only the test leads listed below are required for MIXTURE ADJUSTMENT TESTS although the other leads may remain connected.

1. Insert the BLACK 3 pin POWER/POINTS/DWELL/C-3 (11) connector in the 3 pin BLACK socket on the Analyzer. Connect the RED clip to the Positive (+) battery terminal and the BLACK clip to a secure ground connection on the engine, frame, or alternator bracket. The BLACK clip should be the last connection made and the first to be disconnected. (The GREEN clip is not used for this test.)

WARNING

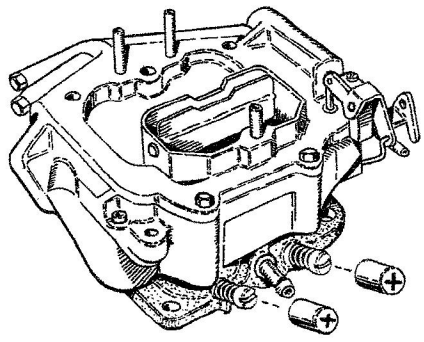
Avoid connecting the BLACK POWER clip directly to the battery Negative (-) terminal in the event that hydrogen gases are present which could explode from sparking connections.

2. Insert the BLUE RPM (13) connector into the BLUE socket of the Analyzer. Clamp the RPM pickup around the No. 1 spark plug wire. The clamp must completely enclose the spark plug wire. See Figure 7-2.
3. Set the ANALOG FUNCTION SELECTOR (4) to RPM.
4. Set the ANALOG RANGE SELECTOR (3) to Low (1200 RPM).

B. ADJUSTMENT PROCEDURE, LEAN DROP METHOD:

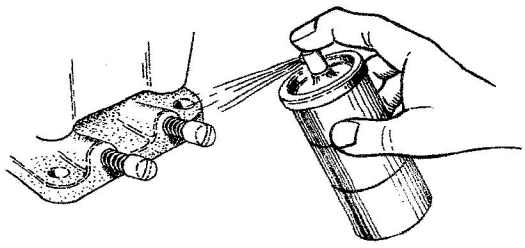
Be sure this is the correct mixture adjustment procedure for your vehicle as recommended by your vehicle service manual. If not, refer to the Test Procedure, Propane Enriched Method.

1. Follow the vehicle service manual or the vehicle emission control label for instructions regarding vacuum hose disconnect procedures.
2. Carefully remove the mixture screw(s) limiter cap(s). Do not bend or distort the mixture screws. See Figure 9-1.



Mixture Adjustment, Limiter Cap Removal, Typical
Figure 9-1

3. Spray the screws and surrounding area liberally with carburetor cleaner until all dirt and grease have been washed away. See Figure 9-2.



Using Carburetor Cleaner on Mixture Screws.
Figure 9-2

NOTE

On two or four venturi carburetors there are two mixture adjustment screws. For the vehicle to run properly, the carburetor adjustments must be balanced. This is accomplished by lightly seating both mixture screws and backing them out an equal amount. For example, if one adjustment is backed out three turns from the lightly seated position, then the other adjustment must also be backed out three turns. During final adjustment, when one screw is turned a fraction of a turn, the other must be turned in the same direction and the same amount. An out of balance carburetor can create drivability problems, the most common of which is mild hesitation on light acceleration from a standing start with a warm engine.

4. Turn the mixture screw(s) clockwise until they lightly seat, counting the number of turns from the starting points to the lightly seated positions.
5. Back out the mixture screw(s) the number of turns specified in the vehicle service manual. If no specification is given, back them out just enough so the engine will run. (This is usually from 1½ to 4 counterclockwise turns from a lightly seated position.)
6. Start and fully warm the engine at curb idle (upper radiator hose is hot).

PRO-TIP

A defective ignition system may cause the tachometer to bounce around or show unsteady and intermittent readings. Low output spark voltage or defective ignition wires may be responsible. You may be able to steady the reading by sliding the RPM pickup along the ignition wire to a new location, or reversing the RPM pickup on the wires as shown in Figure 7-6. If erratic readings persist, move to another ignition wire in the event that the original one may be defective since the RPM pickup can be connected to any spark plug lead. Also, solid copper ignition wires radiate large amounts of radio frequency noise through the air which can interfere with the proper operation of the Analyzer and other electronic equipment. Replace solid copper ignition wire with resistance wire if only for the tests described in this manual.

7. If the engine runs roughly after it is fully warmed up (too lean), turn the mixture screw(s) counterclockwise just until the highest RPM is obtained as shown on the ANALOG METER (1) RPM scale. Do not turn the screws beyond this point.
8. Adjust the idle speed screw or curb idle solenoid as directed by your vehicle service manual to the "Before Lean Drop" speed as specified.
9. Turn the mixture adjustment screw(s) clockwise ⅛ turn at a time. Allow the engine speed to stabilize between adjustments. Continue ⅛ turn adjustments until the "After Lean Drop" speed is reached as shown by the ANALOG METER (1) RPM scale.
10. Re-install the mixture adjustment limiter caps with the tab ¼ turn from the rich (counterclockwise) limit.

NOTE

In most cases, the "After Lean Drop" speed is the same as the Curb Idle Speed in which case no further adjustment is necessary. If they are not the same, proceed to the Idle Speed Adjustment section of this manual.

11. Shut off the engine.

C. ADJUSTMENT PROCEDURE, PROPANE ENRICHED METHOD:

This method of mixture adjustment requires a small propane bottle with the necessary valves and hoses. A kit containing the necessary components and propane is available either from your auto dealership or a local auto parts store. Because of the significant variations between vehicle manufacturers on the procedures used in the "Propane Enrichment" method of fuel mixture adjustment, refer to your vehicle service manual for exact instructions.

As with the Lean Drop Method, this procedure requires RPM measurement. Follow the RPM hookup instructions listed in the Lean Drop section of this chapter to use the Sears 21045 Analyzer for monitoring engine speed during this procedure.

9-3. Idle Speed and Throttle Kicking Solenoid Adjustments.

A. DESCRIPTION. For the engine to run smoothly and not stall or stumble, it is important that the idle speed be within manufacturer's specifications. Idle speeds differ under varying engine operating conditions such as cold engine vs. hot engine, engine load, or air conditioning ON or OFF. Depending on the vehicle and its optional equipment level, one to three idle speed adjustments are necessary. These adjustments will be some combination of the ones described below.

NOTE

Idle speeds are affected by virtually every other engine tune-up adjustment. Perform idle adjustments only after all other repairs and adjustments have been made.

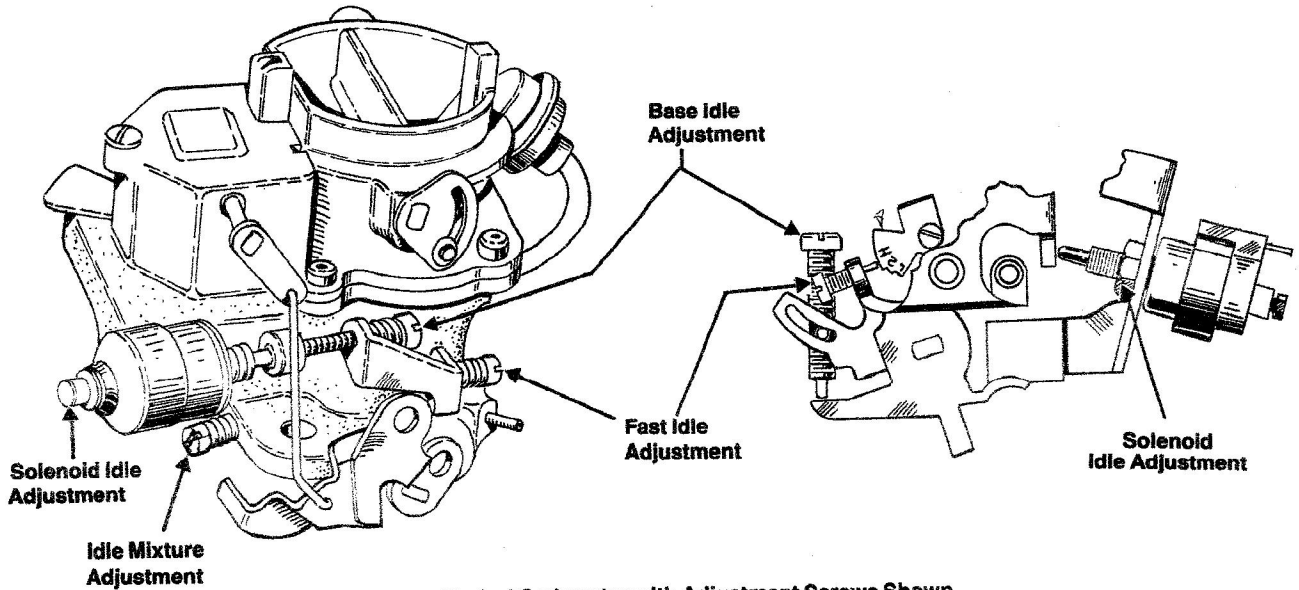
1. Curb Idle Adjustment. This is the idle speed at which the engine runs at normal operating temperature with all accessories OFF.
2. Fast Idle Adjustment. This adjustment controls engine speed from a cold startup to normal operating temperature. Fast Idle is activated by a fast idle cam which is linked to the choke mechanism.
3. Base (Slow) Idle Adjustment. On vehicles with an anti-dieseling solenoid, this speed has two functions. Since it is a lower setting than curb idle, it insures that the engine will shut down (not diesel/or run on) when the key is turned off and the anti-dieseling solenoid releases. Secondly, it acts as a backup curb idle speed in the event that the anti-dieseling solenoid fails.
   Although slower than curb idle, it will keep the engine from stalling and maintain reasonable drivability until proper repairs can be made.
4. Air Conditioning Idle Speed. On some vehicles equipped with air conditioning, an Air Conditioning Idle Solenoid is used. This solenoid is activated when the air conditioning is turned ON and increases idle speed to prevent stalling under the increased load created by the air conditioning. In some applications this solenoid is activated not only by the air conditioning but by the grid type rear window defroster. See Figure 9-3.

NOTE

Different manufacturer's use different names for a solenoid such as Air Conditioning Solenoid, Anti-Dieseling Solenoid, Throttle Positioning Solenoid, Solenoid Idle Stop, or Throttle Kicking Solenoid. This manual will refer to them simply as solenoids which control idle speed under varying operating conditions. Consult your vehicle service manual if necessary to identify the proper solenoid in your vehicle.

B. Preparation:
   Read the vehicle emission control label or vehicle service manual completely and follow all instructions listed for setting idle speeds. Several preliminary steps may need to be taken before the actual adjustment is performed. Some of the more common preparations are:
   1. Vacuum hose to distributor or computer (Remove and plug.)
   2. Canister purge hose (Remove.)
   3. PCV valve (Remove from valve cover.)
   4. Vacuum hose to EGR valve (Remove and plug.)

C. Hookup Procedure (All Idle Adjustments):
   Figure 2-2 shows a hookup procedure for most of the leads on the Sears 21045 Analyzer. Only the test leads listed below are required for IDLE SPEED ADJUSTMENTS although the other leads may remain connected.
   1. Insert the BLACK 3 pin POWER/POINTS/DWELL/C-3 (11) connector in the 3 pin BLACK socket on the Analyzer. Connect the RED clip to the Positive (+) battery terminal and its BLACK clip to a secure ground connection on the engine, frame, or alternator



Typical Carburetor with Adjustment Screws Shown
Figure 9-3

bracket. The BLACK clip should be the last connection made and the first to be disconnected. (The GREEN clip is not used for this test.)

WARNING

Avoid connecting the BLACK POWER clip directly to the battery negative (-) terminal in the event that hydrogen gases are present which could explode from sparking connections.

2. Insert the BLUE RPM (13) connector into the BLUE socket of the Analyzer. Clamp the RPM pickup around the No. 1 spark plug wire. The clamp must completely enclose the spark plug wire. See Figure 7-2.
3. Set the ANALOG FUNCTION SELECTOR (4) to RPM.
4. Set the ANALOG RANGE SELECTOR (3) to Low (1200 RPM).

D. Adjustment Procedure, Curb Idle Adjustment for Engines without Anti-Dieseling Solenoids:

1. Follow vehicle preparation steps previously listed as they apply to the vehicle.
2. Start the engine and operate it at curb idle until it is fully warm (upper radiator hose is hot).
3. If the tachometer reading bounces around, refer to the PRO-TIP presented earlier in this Idle Adjustment Section.

NOTE

Some engines have curb idle set in DRIVE while others are set in NEUTRAL. Use the correct transmission gear and observe necessary safety precautions.

4. While following manufacturer's instructions, adjust the curb idle screw to specification while observing the Low RPM scale (1200 RPM) on the ANALOG METER (1).
5. Proceed to the Air Conditioning Idle Adjustment (if equipped) or the Fast Idle Adjustment.
6. Reconnect hoses or any other items adjusted during the preparation phase if adjustment is complete.

E. Adjustment Procedure, Curb Idle Adjustment for Engines with Anti-Dieseling Solenoids:

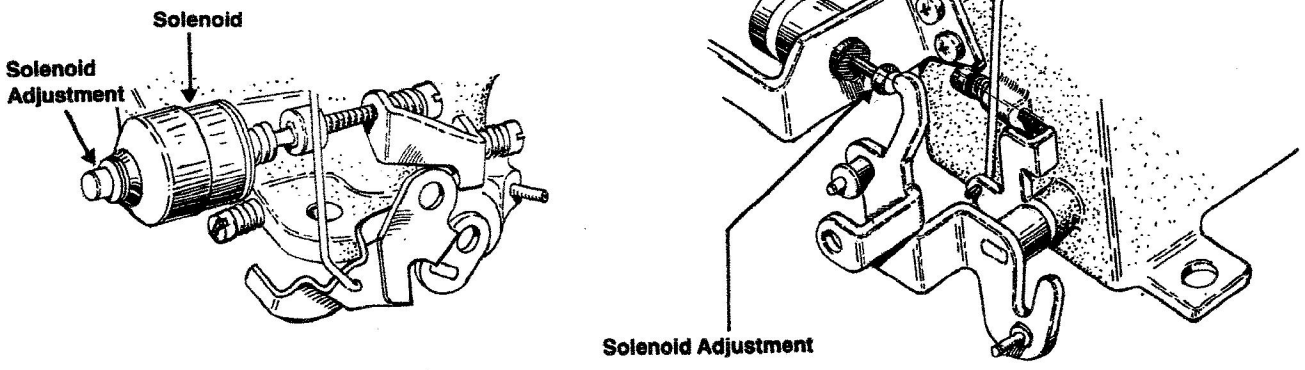
NOTE

On anti-dieseling solenoid equipped engines, curb idle speed is adjusted with the anti-dieseling solenoid. The method of adjustment differs among vehicles, depending on the solenoid's design. For some models, turn the plunger (stem) with an open end wrench; for other models, adjust the recessed Allen screw. For other models, turn the entire body of the solenoid. Consult your vehicle service manual for the proper method of adjustment.

1. Follow vehicle preparation steps previously listed as they apply to the vehicle.
2. Start the engine and operate it at curb idle until it is fully warm (upper radiator hose is hot).

NOTE

Some engines have curb idle set in DRIVE while others are set in NEUTRAL. Use the correct transmission gear and observe necessary safety precautions.
It may be necessary to open the throttle slightly to extend the plunger on the anti-dieseling solenoid.



Typical Throttle Kicker Solenoids
Figure 9-4

3. While following manufacturer's instructions, adjust the anti-dieseling solenoid to specification while observing the Low RPM scale (1200 RPM) on the ANALOG METER (1). If the tachometer reading bounces around, refer to the PRO-TIP presented earlier in this Idle Adjustment section. See Figure 9-4.
4. Proceed to the Fast Idle Adjustment.
5. Reconnect hoses or any other items adjusted during the preparation phase if testing is complete.

F. Adjustment Procedure, Base (Slow) Idle Adjustment for Engines with Anti-Dieseling Solenoids
1. Follow vehicle preparation steps previously listed as they apply to the vehicle.
2. Disconnect the Anti-Dieseling Solenoid as instructed on the vehicle emission control label or in the vehicle service manual. (There is usually a small electrical connector within 6" to 8" of the solenoid body, or connection is made right on the solenoid.)
3. Start the engine and operate it at curb idle until it is fully warm (upper radiator hose is hot).

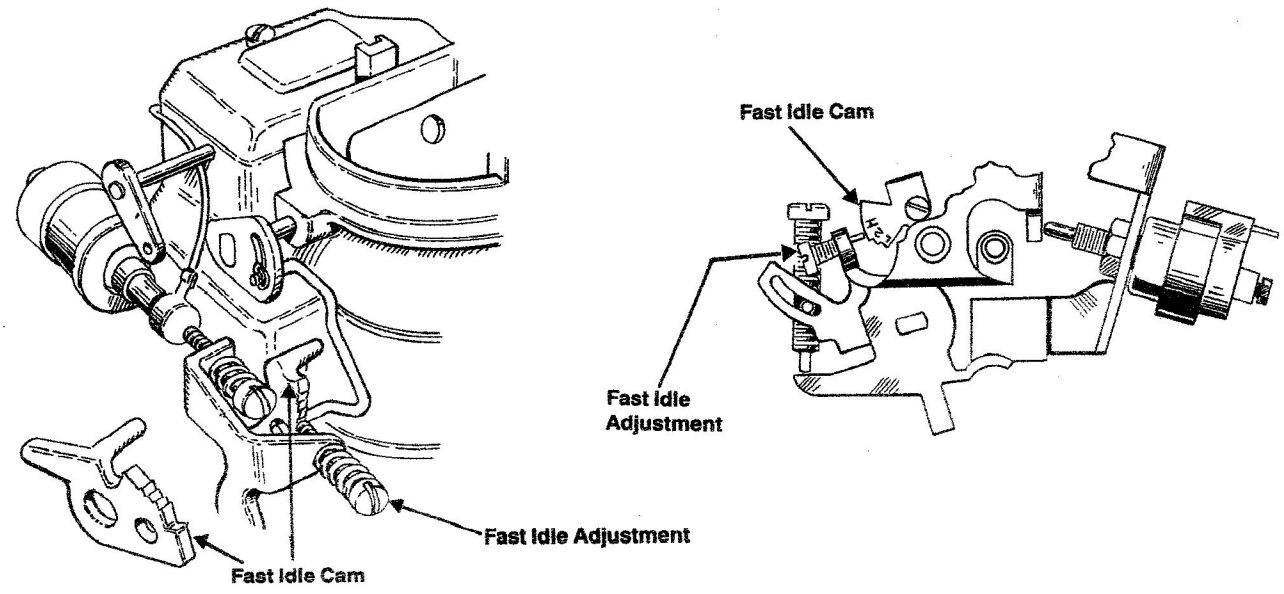
NOTE

Base idle is typically adjusted with the transmission in NEUTRAL, but check the vehicle emission control label or the vehicle service manual to be sure.

4. While following manufacturer's instructions, adjust the base idle screw to specification while observing the Low RPM scale (1200 RPM) on the ANALOG METER (1).
5. If the tachometer reading bounces around, refer to the PRO-TIP presented earlier in this Idle Adjustment Section.
6. Reconnect the Anti-Dieseling Solenoid.
7. Proceed to the Air Conditioning Idle Adjustment (if equipped) or the Fast Idle Adjustment.
8. Reconnect hoses or any other items adjusted during the preparation phase if testing is complete.

G. Adjustment Procedure, Fast Idle Adjustment:
1. Turn the ANALOG RANGE SELECTOR (3) to High (6000 RPM).
2. Follow vehicle preparation steps previously listed as they apply to the vehicle.
3. Start and warm the engine at curb idle (upper radiator hose is hot).
4. Set the fast idle screw on the specified step of the fast idle cam. See Figure 9-5.
5. While following manufacturer's instructions, adjust the fast idle screw to specification while observing the High RPM scale (6000 RPM) on the ANALOG METER (1).
6. If the tachometer reading bounces around, refer to the PRO-TIP presented earlier in this Idle Adjustment section.
7. Release the fast idle cam by opening the throttle slightly.
8. Proceed to air conditioning idle adjustment (if equipped).
9. Reconnect hoses or any other items adjusted during the preparation phase if testing is complete.

H. Adjustment Procedure, Air Conditioning Solenoid Idle Adjustment:



Typical Fast Idle Cams
Figure 9-5

NOTE

On air conditioning solenoid equipped engines, air conditioning idle speed is adjusted with the air conditioning solenoid. The method of adjustment differs depending on the solenoid's design. For some models, turn the plunger (stem) with an open end wrench; for other models, adjust the recessed Allen screw. For other models, turn the entire body of the solenoid. Consult your vehicle service manual for the proper method of adjustment.

1. Follow the vehicle preparation steps previously listed as they apply to the vehicle.
2. Start the engine and operate it at curb idle until it is fully warm (upper radiator hose is hot).
3. Disconnect the air conditioning clutch wire. (There is usually a small connector within 6" to 8" of the air conditioning compressor, or the wiring connector plugs right onto the air conditioning clutch at the front of the air conditioning compressor.)
4. Set the proper switches on the vehicle's dashboard to the air conditioning mode.

NOTE

It may be necessary to open the throttle slightly to extend the plunger on the air conditioning solenoid.

5. While following manufacturer's instructions, adjust the air conditioning solenoid (See Figure 9-4.) to specification while observing the Low RPM scale (1200 RPM) on the ANALOG METER (1).
6. If the tachometer reading bounces around, refer to the PRO-TIP presented earlier in this Idle Adjustment section.
7. Turn OFF the air conditioning switches at the dashboard.
8. Turn OFF the engine.
9. Reconnect the air conditioning clutch wire and any other hoses or items adjusted during the preparation phase if testing is complete.

Section 2. Electronically Controlled Carburetors (1980 to 1984)

9-4. DESCRIPTION. The requirements for lower vehicle emissions, increased fuel economy, and good drivability have created the need for more precise engine control. The majority of the passenger cars sold in the United States since 1981 are using some form of computerized engine controls. The vehicle's on-board computer gathers information from several sensors in the vehicle and on the engine, makes a decision based on the information, and then sends commands to various engine systems. One of the systems which receives such a command is the electronically controlled carburetor. The following procedures are basic performance checks of the electronically controlled carburetor.

CAUTION

The computer controlled vehicles of the 1980's represent great technological advancement. They use complex, sophisticated computerized systems to control engine and drive train functions. Although these components are completely serviceable, the vehicle service manual is necessary when performing tests or repairs on these vehicles. The procedures outlined in this section are basic, simple checks which can be performed on the listed vehicles. Complete testing is outlined in the vehicle service manual. Read and follow the manufacturer's instructions carefully for best results.

9-5. General Motors C-3 System Performance Check (Computer Command Control).

NOTE

This procedure is NOT to be used on fuel injected engines.

Introduced in 1978 on a limited number of California engines, the C-3 system is now standard equipment on most of the General Motors vehicles. The main function of the C-3 system is to maintain the carburetor air-fuel ratio at 14.7 to 1.0, the most efficient operating ratio. The electronic carburetor receives a dwell-type voltage signal from the Electronic Control Module (ECM) to maintain this air-fuel ratio under widely varying driving conditions. Your Sears Analyzer can be used to monitor the results of the C-3 system performance check by following the hookup and test procedures shown below.

NOTE

The C-3 System could be malfunctioning when any of the following conditions are noticed:

A. The vehicle's instrument panel "CHECK ENGINE" or "SERVICE ENGINE SOON" light illuminates.
B. Poor engine performance which includes:
   1. Poor gas mileage
   2. Lack of response to throttle
   3. Hesitation, stalling, etc.

Because each system is tailored to meet the requirements of a specific car line, it is recommended that you obtain the specific service manual for your vehicle for complete C-3 system diagnostics, troubleshooting, and repair procedures.

A. Hookup Procedure:
Figure 2-2 shows a hookup procedure for most of the leads on the Sears 21045 Analyzer. Only the test leads listed below are required for C-3 SYSTEM CHECKS although the other leads may remain connected.

1. Insert the BLACK 3 pin POWER/POINTS/DWELL/C-3 (11) connector in the 3 pin BLACK socket on the Analyzer. Connect the RED clip to the Positive (+) battery terminal. Insert the adapter into the GREEN M/C connector on the vehicle as shown in Figure 9-6. Connect the BLACK clip to a secure ground connection on the engine, frame, or alternator bracket. The BLACK clip should be the last connection made and the first to be disconnected.

WARNING

Avoid connecting the BLACK POWER clip to the battery Negative (-) terminal in the event that hydrogen gases are present which could explode from sparking connections.

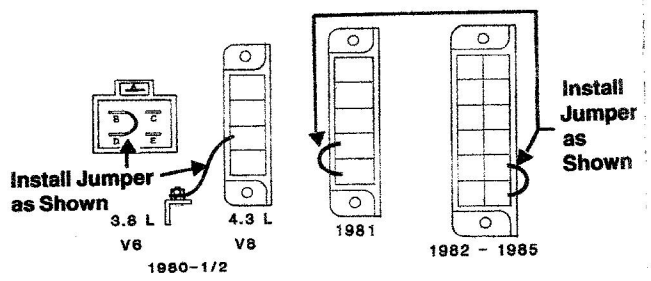
2. Insert the BLUE RPM (13) connector into the BLUE socket of the Analyzer. Clamp the RPM pickup around the No. 1 spark plug wire. The clamp must completely enclose the spark plug wire. See Figure 7-2.
3. Set the ANALOG FUNCTION SELECTOR (4) to RPM.
4. Set the ANALOG RANGE SELECTOR (3) to High (6000 RPM).

B. Test Procedure, 1981 Vehicles:

NOTE

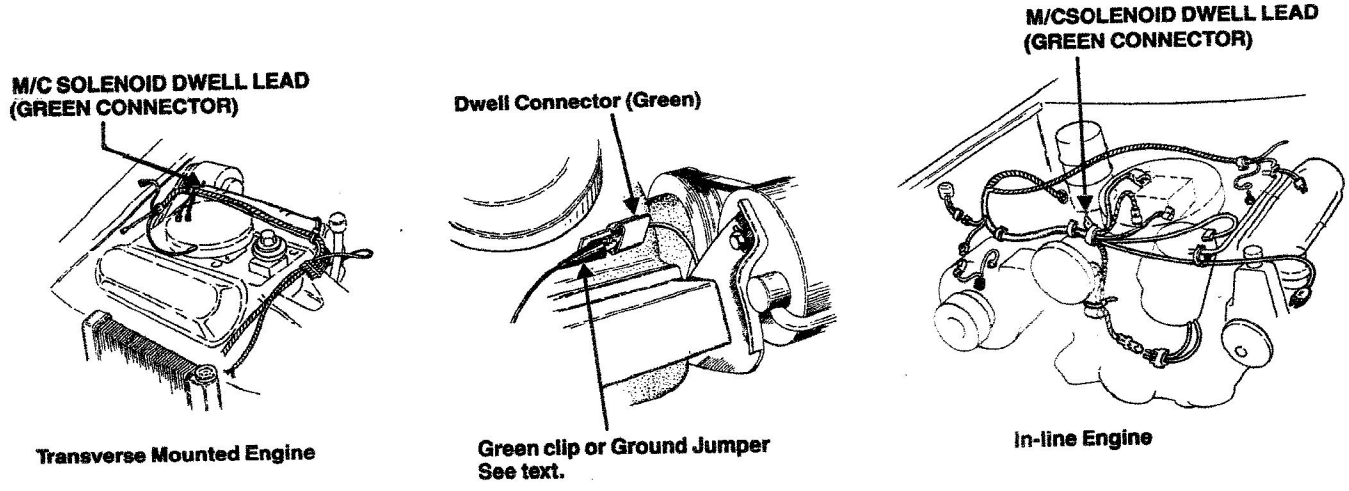
It is suggested that the technician read and become familiar with this procedure before beginning the test.

1. Start the engine.
2. Ground the test terminal. See Figure 9-7.
   Do NOT ground this terminal before the engine is started.

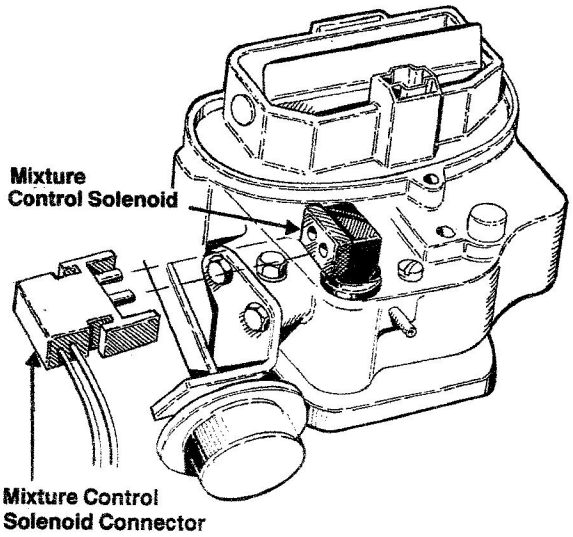


GM Test Terminal Connection Configurations
Figure 9-7

3. Disconnect the purge hose from its canister and plug it. For Varajet carburetors, disconnect the bowl vent at the carburetor and plug the hose to the canister.
4. Disconnect the mixture control (M/C) solenoid at the carburetor, and ground the M/C solenoid dwell lead with the jumper wire supplied. See Figures 9-6 and 9-8.



Typical GM C-3 Dwell Connector Locations
Figure 9-6



Typical Mixture Control Solenoid Connection
Figure 9-8

5. Operate the engine at 3000 RPM with the throttle constant. Reconnect the M/C solenoid and record the RPM. The RPM of a car with an electric cooling fan may lower when the fan engages; this RPM drop should be ignored.
6. Remove the ground jumper from the M/C solenoid dwell terminal (green connector) **before** returning the engine to idle.

If the RPM drops less than 100 RPM:

7. Check for a clean and tight connection between the pink wire and the right hand terminal of the M/C solenoid.

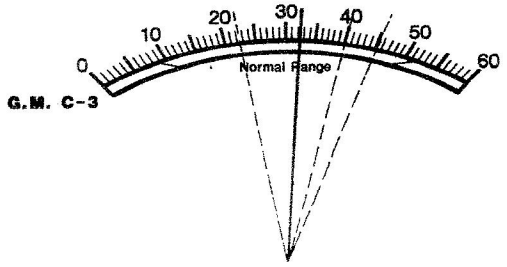
If the RPM drops more than 100 RPM:

8. Connect the GREEN clip to the M/C solenoid dwell lead. Do not allow leads to touch ground or hoses—the hoses may also be conductive. See Figure 9-6.
9. Set the ANALOG FUNCTION SELECTOR (4) to GM C-3.
10. Set the carburetor on the high step of the fast idle cam and run the engine for one minute or until the dwell starts to vary.

NOTE

The input to the C-3 system which causes the constantly varying dwell action reading is an oxygen sensor mounted on the exhaust manifold working through the ECM. This sensor must typically be above 600°F to operate properly. Engine cooling, restart, or excessive idling could cause the sensor to go below 600°F in which case the dwell action readings will be some FIXED value between 10° and 50°. This system may require three to four minutes to reach temperature after a restart or cool down to resume the varying-dwell operational mode. If the results of your testing don't agree with the Test Results given, consult the vehicle service manual for further diagnostic procedures.

11. Return the engine to idle and observe the appropriate dwell scale on the ANALOG METER (1). See Figure 9-9.



GM C-3 Varying Dwell Indication
Figure 9-9

C. Test Results:

1. Normal
   Dwell Varies. Check the dwell meter at 3000 RPM. The dwell should vary between 10° and 50°. If the dwell falls in this range, check the Air Management System according to the instructions in your vehicle service manual to complete your GM C-3 System Performance Check.
2. Abnormal
   The abnormal test results listed below will direct you to the most likely problem areas. These test results may indicate a defect in the vehicle. **Consult your vehicle service manual for the proper procedures to check these problem areas.**

   a. The dwell varies but not in the 10° to 50° range.
   b. The dwell is fixed under 10°.
   c. The dwell is some fixed value between 10° and 50°.
   d. The dwell is some fixed value over 50°.

D. Test procedure, 1982/1983/1984:

NOTE

It is suggested that the technician read and become familiar with this procedure before beginning the test.

1. Start the engine and operate it at curb idle until it is fully warm (upper radiator hose hot).
2. Ground the test terminal. See Figure 9-7. Ground this terminal only **after** the engine is started.
3. Disconnect the Mixture Control (M/C) Solenoid at the carburetor as shown in Figure 9-8.
4. Ground the M/C Solenoid dwell connector with the jumper wire supplied as shown in Figure 9-6.
5. Operate the engine at 3000 RPM. Reconnect the M/C Solenoid and record the RPM. The RPM of a car with an electric cooling fan may lower when the fan engages; this RPM drop should be ignored.

6. Remove the ground jumper from the M/C Solenoid dwell terminal before returning the engine to idle.

If the RPM drops less than 300 RPM or the RPM increases:

7. Check for a clean and tight connection between the pink wire and the right hand terminal of the M/C solenoid.
8. Check for excess fuel in the evaporator canister and/or the crankcase.
9. If Steps 7 and 8 give good results, proceed to "Carburetor On-Vehicle Service" in your vehicle service manual.

If the RPM drops more than 300 RPM:

10. Connect the GREEN clip to the M/C Solenoid dwell terminal. See Figure 9-6. DO NOT ALLOW LEADS TO TOUCH GROUND OR HOSES—THE HOSES MAY ALSO BE CONDUCTIVE. Turn the ANALOG FUNCTION SELECTOR (4) to GM C-3.
11. Set the carburetor on the high step of the fast idle cam and run the engine for one minute or until dwell starts to vary.

NOTE

The input to the C-3 system which causes the constantly varying dwell action reading is an oxygen sensor mounted on the exhaust manifold working through the ECM. This sensor must typically be above 600°F to operate properly. Engine cooling, restart, or excessive idling could cause the sensor to go below 600°F in which case the dwell action readings will be some FIXED value between 10° and 50°. This system may require three to four minutes to reach temperature after a restart or cooldown to resume the varying-dwell operational mode. If the results of your testing don't agree with the Test Results given, consult the vehicle service manual for further diagnostic procedures.

12. Return the engine to idle and note the dwell reading on the ANALOG METER (1). See Figure 9-9.

E. Test Results:

1. Normal
   Dwell Varies. Check the dwell meter at 3000 RPM. The dwell meter should vary between 10° and 50°. If the dwell meter falls in this range, check the Air Management System according to the instructions in your vehicle service manual to complete your GM C-3 System Performance Check.
2. Abnormal
   The abnormal test results listed below will direct you to the most likely problem areas. These test results may indicate a defect in the vehicle.
   Consult your vehicle service manual for the proper procedures to check these problem areas.
   a. The dwell varies but not in the 10° to 50° range.
   b. The dwell reading is some fixed value under 10°.
   c. The dwell reading is some fixed value between 10° and 50°.
   d. The dwell reading is some fixed value over 50°.

9-6. Chrysler EFCS (Electronic Fuel Control System) Performance Check, 1981-1984. The following procedure checks that the Electronic Feedback Carburetor is responding to changes in air/fuel ratio as seen by the Oxygen Sensor. Conditions are manually created which cause a very rich mixture and a very lean mixture for testing purposes. These conditions will cause the computer controlled system to respond accordingly and attempt to bring the air/fuel ratio back to the ideal mixture of 14.7:1. There are several tests involved to totally confirm the operation of the complete engine control system. See your vehicle service manual for additional information. The procedure described below will confirm the operation of this critical portion of the system.

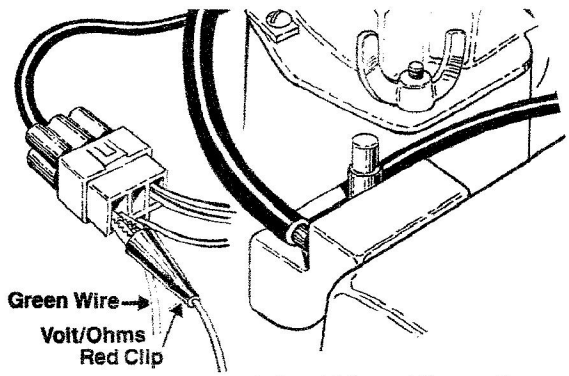
A. Hookup Procedure (All Tests):

1. Insert the BLACK 3 pin POWER/POINTS/DWELL/C-3 (11) connector in the 3 pin BLACK socket on the Analyzer. Connect the RED clip to the Positive (+) battery terminal and the BLACK clip to a secure ground connection on the engine, frame, or alternator bracket. The BLACK clip should be the last connection made and the first to be disconnected. (The GREEN clip is not used for this test.)

WARNING

Avoid connecting the BLACK POWER clip directly to the battery Negative (-) terminal in the event that hydrogen gases are present which could explode from sparking connections.

2. Insert the BLUE RPM (13) connector into the BLUE socket of the Analyzer. Clamp the RPM pickup around the No. 1 spark plug wire. The clamp must completely enclose the spark plug wire. See Figure 7-2.
3. Insert the WHITE VOLTS/OHMS (14) connector into the WHITE socket on the Analyzer. Connect the RED clip to the carburetor solenoid output (GREEN) wire and the BLACK clip to the Negative (-) battery terminal or a clean, secure ground connection. See Figure 9-10.



Typical Chrysler Solenoid Output Connection (Typical 2.2 Liter Shown)
Figure 9-10

NOTE

If it is necessary to move the BLACK clip, do not use the carburetor or other fuel system components as a ground connection since a spark could ignite the gasoline vapors and cause a fire or an explosion.

4. Set the ANALOG FUNCTION SELECTOR (4) to RPM.
5. Set the ANALOG RANGE SELECTOR (3) to High (6000 RPM).
6. Set the DIGITAL FUNCTION SELECTOR to Volts.
7. Set the DIGITAL RANGE SELECTOR to 200 Volts.

NOTE

Select the Test Procedure below which matches your vehicle.

B. Test Procedure, 1981-82 Front Wheel Drive, 1.7 liter and 2.2 liter:

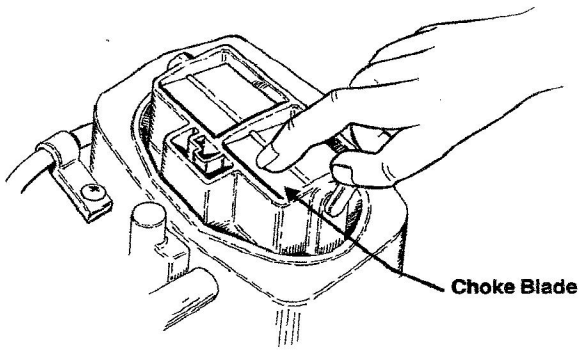
CAUTION

Read the following procedure thoroughly and become familiar with the engine components discussed. **Steps 4 through 9 should be completed within 90 seconds.**

1. Push the DIGITAL POWER (9) ON.
2. Start the engine and operate it at curb idle until it is fully warm (upper radiator hose is hot).
3. Increase the engine speed to 2000 RPM and hold from Steps 3 through 8. Monitor the RPM on the ANALOG METER (1) 6000 RPM scale.

Rich Test, Steps 4 to 6.

4. Hold the choke blade(s) closed as shown in Figure 9-11.



Rich Test, Choke Blades Closed
Figure 9-11

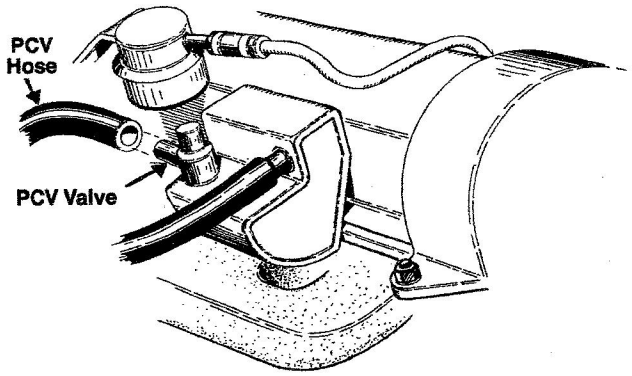
5. During the next 10 seconds, the voltage as read on the DIGITAL DISPLAY (6) will decrease to 3.0 Volts or less and should maintain that level until the choke blades are released. See Figure 9-12.

DIGITAL DISPLAY, Rich Test (Chrysler), Typical
Figure 9-12

6. Release the choke blades.

Lean Test, Steps 7 to 9:

7. Disconnect the PCV system as shown in Figure 9-13.



Disconnected PCV System (Typical 2.2 Liter shown)
Figure 9-13

8. During the next 10 seconds, the voltage as read on the DIGITAL DISPLAY (6) will increase to 9.0 Volts or greater and should maintain that level until the PCV system is reconnected. See Figure 9-14.

DIGITAL DISPLAY, Lean Test (Chrysler), Typical
Figure 9-14

9. Reconnect the PCV system.
10. Return the engine to curb idle and shut it OFF.
11. Push the DIGITAL POWER (9) OFF.

C. Test Procedure, 1983-84 Front Wheel Drive, 1.6 liter, 1.7 liter, and 2.2 liter:

CAUTION

Read the following procedure thoroughly and become familiar with the engine components discussed. **Steps 5 through 10 should be completed within 90 seconds.**

1. Push the DIGITAL POWER (9) ON.
2. Start the engine and operate it at curb idle until it is fully warm (upper radiator hose hot).
3. Disconnect and plug the vacuum hose to the spark control computer. Connect an auxiliary vacuum source, such as the Sears 161.2193 Vacuum Pump, to the vacuum diaphragm on the spark control computer and apply 14" of vacuum to it.
4. Increase the engine speed to 2000 RPM and hold from Steps 5 through 10. Monitor the RPM on the ANALOG METER (1) 6000 RPM scale.

Rich Test, Steps 5 to 7:

5. Hold the choke blade(s) closed as shown in Figure 9-11.
6. During the next 10 seconds, the voltage as read on the DIGITAL DISPLAY (6) will decrease to 5.0 Volts or less and should maintain that level until the choke blades are released. See Figure 9-12.
7. Release the choke blades.

Lean Test, Steps 8 to 10:

8. Disconnect the PCV system as shown in Figure 9-13.
9. During the next 10 seconds, the voltage as read on the DIGITAL DISPLAY (6) will increase to 10.0 Volts or greater and should maintain that level until the PCV system is reconnected. See Figure 9-14.
10. Reconnect the PCV system.
11. Return the engine to curb idle and shut it OFF.
12. Push the DIGITAL POWER (9) OFF.

D. Test Procedure, 1981-83 Rear Wheel Drive, 3.7 liter and 5.2 liter:

CAUTION

Read the following procedure thoroughly and become familiar with the engine components discussed. **Steps 4 through 9 should be completed within 90 seconds.**

1. Push the DIGITAL POWER (9) ON.
2. Start the engine and operate it at curb idle until it is fully warm (upper radiator hose is hot).
3. Increase the engine speed to 1500 RPM and hold from Steps 4 through 9. Monitor the RPM on the ANALOG METER (1) 6000 RPM scale.

Rich Test, Steps 4 to 6:

4. Hold the choke blade(s) closed as shown in Figure 9-11.
5. During the next 10 seconds, the voltage as read on the DIGITAL DISPLAY (6) will decrease to 3.0 Volts or less and should maintain that level until the choke blades are released. See Figure 9-12.
6. Release the choke blades.

Lean Test, Steps 7 to 9:

7. Disconnect the PCV system as shown in Figure 9-13.
8. During the next 10 seconds, the voltage as read on the DIGITAL DISPLAY (6) will increase to 9.0 Volts or greater and should maintain that level until the PCV system is reconnected. See Figure 9-14.
9. Reconnect the PCV system.
10. Return the engine to curb idle and shut it OFF.
11. Push the DIGITAL POWER (9) OFF.

E. Test Procedure, 1984 Rear Wheel Drive:

The procedure for this engine is very specific to the particular engine and carburetor on the vehicle. Refer to your vehicle service manual for a full explanation of the Performance Check for your engine.

F. Test Results, Summary for All Vehicles:

1. Normal
   a. **Rich Test:** 3.0 Volts or less (5.0 Volts for 1983-84 Front Wheel Drive)
   b. **Lean Test:** 9.0 Volts or more (10.0 Volts for 1983-84 Front Wheel Drive)
2. Abnormal
   a. **Rich Test:** Voltage will not drop to 3.0 Volts or less (1983-84 Front Wheel Drive will not drop below 5.0 Volts).
   b. **Lean Test:** Voltage will not rise to 9.0 Volts or more (1983-84 Front Wheel Drive will not rise above 10.0 Volts).

See the Electrical, Fuel, and Emission sections of your vehicle service manual for further diagnosis.

9-7. Ford Motor Company Electronic Engine Control Systems (1981-1984) Performance Checks. Ford Motor Company has developed and used several electronic systems for precise fuel control of both carbureted and fuel injected engines. See Table 9-1. These systems also control other engine functions such as Thermactor and Spark Advance Control Systems. Because of the large number of Ignition and Control Systems in use, refer to the vehicle service manual for your specific vehicle for proper troubleshooting and performance testing techniques. Ignition System general service procedures are in Group 23 of the Ford Service Manual. Engine Control System performance testing and troubleshooting procedures will be found in the Engine/Emission/Electronics book of the manual, and Vehicle/System identification assistance is available in Group 10—Identification Codes. Your Sears 161.21045 is totally compatible with the Ford systems and should be used with the appropriate vehicle service manual.

9-8. Electronically Controlled Fuel Systems—IMPORTS. The manufacturers of imported vehicles must meet the same fuel economy and emission standards as the American manufacturers. On-board computers and electronic engine controls are extensively used to meet these requirements. Although these sections do not apply directly to the import vehicle, read the "General Motors C-3 System Performance Check" and the "Chrysler EFCS (Electronic Fuel Control System) Performance Check" in Chapter 9 of this manual to gain a basic knowledge of how the electronically controlled carburetor works. Keep in

YEAR	IGNITION SYSTEM*	CONTROL SYSTEM*
1981	1) Duraspark II 2) Duraspark III 3) Thick Film Ignition	A) Electronic Engine Control (EEC) III B) Microprocessor Control Unit (MCU), 4 & 6 Cylinder Engines C) Microprocessor Control Unit (MCU), 8 Cylinder Engine
1982	1) Duraspark II 2) Duraspark II with Universal Ignition Module (UIM) 3) Duraspark III 4) Thick Film Ignition	A) Electronic Engine Control (EEC) III B) Microprocessor Control Unit (MCU), I-4 & I-6 Engines C) Microprocessor Control Unit (MCU), V-6 & V-8 Engines
1983	1) Duraspark II 2) Duraspark II with Universal Ignition Module (UIM) 3) Duraspark III 4) Thick Film Ignition 5) Thick Film Ignition IV	A) Electronic Engine Control (EEC) III B) Electronic Engine Control (EEC) IV C) Microprocessor Control Unit (MCU) I-4 Engine D) Microprocessor Control Unit (MCU) V-8 Engine
1984	1) Duraspark II 2) Duraspark II with Universal Ignition Module (UIM) 3) Thick Film Ignition 4) Thick Film Ignition IV	A) Electronic Engine Control (EEC) IV B) Microprocessor Control Unit (MCU) V-8 Engine

*Ignition and Control Systems may be matched in varying order within a give year.

TABLE 9-1

mind that each manufacturer adapts this technology in a specific fashion to meet his needs. It is, therefore, highly recommended that the technician obtain a vehicle service manual for his specific vehicle and that the technician follow the manufacturer's instructions for testing his electronic systems carefully for best results.

Section 3. FUEL INJECTION

9-9. Description. Many vehicle manufacturers are replacing carburetors with fuel injection systems to meet the increased demands for lower emission levels, increased fuel economy, and improved drivability. The introduction and continuing improvement of vehicle on-board computers coupled with fuel injection is making fuel control more precise than is possible with a carburetor. There are two basic types of fuel injection commonly used in modern passenger vehicles, the Single Point Injection System and the Multi-Point Injection System. Vehicle manufacturers use a variety of names for these systems. The more common systems are listed below.

A. Single Point Fuel Injection

1. American Motors Corporation
   a. Throttle Body Fuel Injection
   b. Single Point Fuel Injection (SPI)
2. Chrysler Corporation
   Electronic Fuel Injection (EFI)
3. Ford Motor Company
   a. Electronic Fuel Injection (EFI) 1982-83 except Escort/Lynx and EXP/LN7
   b. Central Fuel Injection (CFI) 1983-84
4. General Motors Corporation
   a. Electronic Fuel Injection (EFI)
   b. Throttle Body Injection (TBI)
   c. Cross-Fire Injection

> **NOTE**
>
> The Cross-Fire Injection System consists of two throttle-body assemblies mounted on the Inlet Manifold Cover. CFI is a two point injection system.

B. Multi-Point Fuel Injection Systems

1. American Motors Corporation
   Multi-Point Fuel Injection (MPI)
2. Chrysler Corporation
   Multi-Point Fuel Injection
3. Ford Motor Company
   Electronic Fuel Injection (EFI)
   1983-84, 1.6 liter and 2.3 liter engines
4. General Motors Corporation
   a. Multi-Point Fuel Injection (MFI)
   b. Port Fuel Injection (PFI)
   c. Sequential Fuel Injection (SFI)
   d. Tuned Port Injection (TPI)

Fuel injection is closely tied with the vehicle's on-board computer, and in effect they become one integrated system. Each manufacturer's system(s) is unique, and any adjustments must be made in accordance with the manufacturer's instructions (available in the vehicle service manual).

Adjustments are often limited to a base idle setting or in some cases "minimum and maximum authority" idle speeds. Use your Sears 21045 Analyzer in conjunction with the vehicle emission control label and vehicle service manual to perform these adjustments. The Hookup Procedure for monitoring engine RPM is shown below.

Hookup Procedure:

1. Insert the BLACK 3 pin POWER/POINTS/DWELL/C-3 (11) connector in the 3 pin BLACK socket on the Analyzer. Connect the RED clip to the Positive (+) battery terminal and the BLACK clip to a secure ground connection on the engine, frame, or alternator bracket. The BLACK clip should be the last connection made and the first to be disconnected. (The GREEN clip is not used for this test.)

WARNING

Avoid connecting the BLACK POWER clip directly to the battery Negative (-) terminal in the event that hydrogen gases are present which could explode from sparking connections.

2. Insert the BLUE RPM (13) connector into the BLUE socket of the Analyzer. Clamp the RPM pickup around the No.1 spark plug wire. The clamp must completely enclose the spark plug wire. See Figure 7-2.
3. Turn the ANALOG FUNCTION SELECTOR (4) to RPM and the ANALOG RANGE SELECTOR (3) to the appropriate scale as required by your vehicle service manual procedures.

PRO-TIP

A defective ignition system may cause the tachometer to bounce around or show unsteady and intermittent readings. Low output spark voltage or defective ignition wires may be responsible. You may be able to steady the reading by sliding the RPM pickup along the ignition wire to a new location, or reversing the RPM pickup on the wires as shown in Figure 7-6. If erratic readings persist, move to another ignition wire in the event that the original one may be defective since the RPM pickup can be connected to any spark plug lead. Also, solid copper ignition wires radiate large amounts of radio frequency noise through the air which can interfere with the proper operation of the Analyzer and other electronic equipment. Replace solid copper ignition wire with resistance wire if only for the tests described in this manual.

CHAPTER 10.
OHMMETER TESTING

10-1. DESCRIPTION. The OHMMETER is used to measure the electrical resistance of the various components of electrical systems. OHMMETER TESTS are always done in a circuit or a component when NO power is applied to the circuit or component. Any attempt to use an ohmmeter in a live circuit will produce false results and may damage the instrument. In many cases the suspect component must be disconnected from the circuit to obtain an accurate reading. The OHMMETER portion of your Sears 21045 Analyzer is powered by an internal 9 volt battery. This allows Analyzer portability for off-the-vehicle bench testing. Replace the battery as directed in Chapter 2 whenever "LO BAT" appears on the DIGITAL DISPLAY (6). A good battery will read only "1" when the clips are open and the Analyzer is set for ohmmeter testing. This section of the manual covers the testing of some of the more common circuits/components in the vehicle as well as those items referred to in earlier test procedures in this manual.

10-2. DIRECTIONS FOR USE. The Ohmmeter has three scales: 200 ohms, 2 K (2000 ohms) and 200 K (200,000 ohms). Reading these scales on the DIGITAL DISPLAY (6) becomes easy with practice. See Tables 2-2 and 10-1. Note that the letter *K* represents kilo which means 1000 on the 2 K and 200 K scales. The 200 ohm scale is read directly. The table below gives examples of typical Ohmmeter readings.

A. Low Resistance Measurements

On the 200 ohm scale, this Analyzer is capable of measuring very low resistance, down to .1 ohm, (1/10 of an ohm). Because the test leads have a small resistance to them, it is unlikely that the DIGITAL DISPLAY (6) will ever read 00.0 on the 200 ohm scale of the Analyzer with the test leads shorted together. The Analyzer will read the resistance of the test leads themselves in such a case.

With the leads shorted together on the Analyzer, the reading will likely be between 00.2 and 00.3. The actual lead resistance must be known before making any low resistance tests. The lead resistance must be subtracted from the reading obtained when using the 200 ohm scale for testing purposes to obtain an accurate low resistance reading. For resistances above 10 ohms, the lead resistance may be ignored. For example, to determine the resistance of a ballast resistor, follow these steps:

1. Short the Ohmmeter test leads together on the 200 ohm scale and record the reading (example: 00.3 ohms) on the DIGITAL DISPLAY (6).
2. Connect the Ohmmeter leads across the ballast resistor terminals and record the reading (example: 00.8 ohms) on the DIGITAL DISPLAY (6).
3. To obtain the actual resistance of the ballast resistor, subtract the Ohmmeter lead resistance from the test result (00.8 ohms–00.3 ohms = 00.5 ohms, the true ballast resistor resistance reading).

B. Short or Open Circuit Readings

A short circuit (continuity) will be displayed as 000 on the DIGITAL DISPLAY (6) with the appropriate decimal point illuminated except as noted in the previous paragraph about "Low Resistance Measurements." An open circuit (no continuity) or the over-range indication will be displayed as "1" on the DIGITAL DISPLAY (6). If this display is seen during resistance measurements, move the DIGITAL RANGE SELECTOR (8) clockwise one position at a time until a valid (multi-digit) reading is obtained. If the overrange indication is still present when the 200 K Ohms position of the DIGITAL RANGE SELECTOR is reached, the component or circuit being measured is either open or its resistance has exceeded the measuring capacity of this Ohmmeter (200 K Ohms). The majority of the electrical circuits/components found in the vehicle are of a relatively low resistance, well within the measuring capability of this Analyzer. Therefore, an overrange indication on the 200 K Ohms scale will be an open circuit (no continuity) in all but a few isolated cases. Consult your vehicle service manual for specific resistance values for components under test.

10-3. Spark Plug Wires. The spark plug wires in use today are referred to as resistance or suppression type wires. Unlike conventional wire which will provide a zero (0) ohm reading on an ohmmeter, spark plug wires will show resistance when tested with an ohmmeter. Although

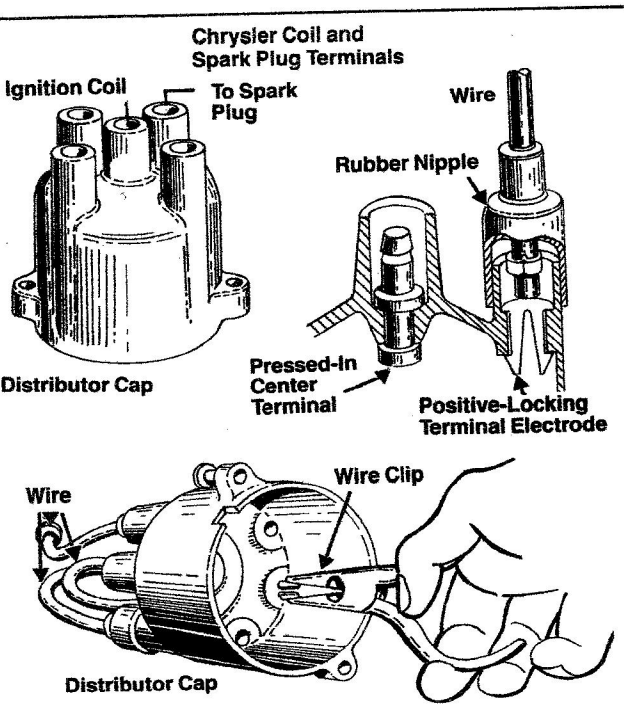
SCALE	RANGE	RESOLUTION	DIGITAL DISPLAY READING
200 ohms	00.0 - 199.9 ohms	.1 ohm	78.3 = 78.3 ohms
200 ohms	00.0 - 199.9 ohms	.1 ohm	151.6 = 151.6 ohms
2 K	.000 - 1.999 K ohms	1 ohm	.375 x 1000 = 375 ohms
2 K	.000 - 1.999 K ohms	1 ohm	1.752 x 1000 = 1752 ohms or 1.752 K ohms
200 K	00.0 - 199.9 K ohms	100 ohms	07.5 x 1000 = 7500 ohms or 7.5 K ohms
200 K	00.0 - 199.9 K ohms	100 ohms	93.5 x 1000 = 93,500 ohms or 93.5 K ohms
200 K	00.0 - 199.9 K ohms	100 ohms	165.2 x 1000 = 165,200 ohms or 165.2 K ohms

TABLE 10-1

designed to withstand extreme temperature conditions and high voltage, spark plug wires CANNOT withstand physical abuse. When removing these wires, grasp the wires only at the boots at both the spark plug end and the distributor end. Twist the boots about a half turn while pulling gently to remove them. The test procedure below will check these wires for open circuits, proper resistance, and intermittent opens.

CAUTION

Some Chrysler products use a "positive-locking" terminal electrode spark plug wire. As shown by Figure 10-1, these plug wires can only be removed from inside the distributor cap. Damage may result to components if other means of removal are attempted.



CHRYSLER COIL AND SPARK PLUG TERMINALS
REMOVING CHRYSLER SPARK PLUG WIRES
Figure 10-1

NOTE

Some spark plug wires have sheet metal jackets with the following symbol: —▶◀—. This type of plug wire contains an "air gap" resistor. Wires of this type cannot be checked with an ohmmeter. An oscilloscope must be used.

A. Hookup Procedure:
1. Insert the WHITE VOLTS/OHMS (14) connector into its WHITE socket on the Analyzer.
2. Press the DIGITAL POWER push button (9) ON.
3. Set the DIGITAL FUNCTION SELECTOR (7) to Ohms.
4. Set the DIGITAL RANGE SELECTOR (8) to 200 K Ohms.

B. Test Procedure:
1. Connect the RED and BLACK clips of the VOLTS/OHMS (14) lead to each end of the spark plug wire as shown in Figure 10-2. It may be necessary to use a small screwdriver or nail to reach the recessed metal connectors inside the boots. Check for a tight connection. If more than one spark plug wire is removed for the test, clearly mark the wires and their locations on the engine to make replacement easier.
2. While observing the DIGITAL DISPLAY (6), gently flex the plug wire its full length. Then, gently flex each end of the spark plug wire between the wire and the boot. Defects most often occur where the wire meets the boot. The DIGITAL DISPLAY (6) should remain steady and not change its reading during this step.

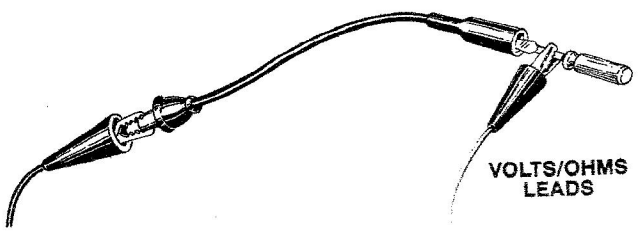
NOTE

The far right digit (representing hundreds of ohms) on the DIGITAL DISPLAY (6) may change during the test procedure. This is acceptable.

3. Record the reading on the DIGITAL DISPLAY (6).
4. Disconnect the test leads from the plug wire. Reconnect both ends of the spark plug wire to the engine.
5. Repeat the procedure for the remaining plug wires and the coil tower wire (when equipped).
6. Press the DIGITAL POWER (9) OFF if testing is complete.

C. Test Results:
1. Normal
The display should indicate plug wire resistance as indicated by the manufacturer's specifications. The display should remain steady as indicated above. If at any time the display reads infinity (overange) "1," it indicates that the wire is open and should be replaced. Typically these wires have resistances no lower than about 1000 ohms (.010 on 200 K range) and not greater than 50,000 ohms (.500 on 200 K range). If manufacturer's specifications are not available, use the following table as a guide. Typically the shorter the wire, the lower the resistance.

2. Abnormal
The abnormal test results listed below will direct you to the most likely problem areas. These test results may indicate a defect in the vehicle. Consult your



DISTRIBUTOR END BLACK SPARK PLUG END RED
Spark Plug Test Connections.
Figure 10-2

vehicle service manual for the proper procedures to check these problem areas.

a. Wire resistance does not fall within manufacturer's specifications.
b. The display flashes significantly indicating an intermittent open.
c. The display shows "1" indicating an open wire.

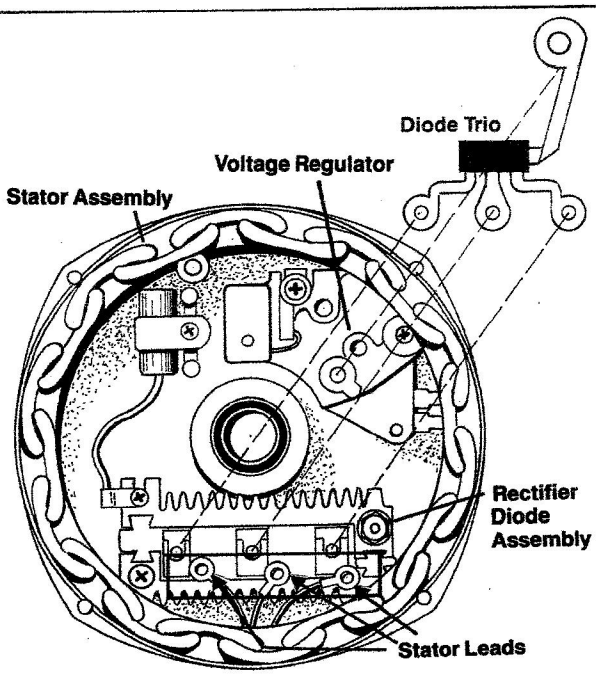
10-4. Alternator Testing. The OHMMETER of the Sears 21045 Analyzer provides a positive method for checking diodes, rotors, and stators in an alternator. If the ALTERNATOR CONDITION and ALTERNATOR OUTPUT Test Procedures presented earlier in this manual have indicated an alternator problem, this procedure along with your vehicle service manual will pinpoint the problem area.

A. Preparation:

1. Remove the alternator from the vehicle and disassemble as directed by your vehicle service manual.
2. Disconnect the three stator leads from the diodes as shown in Figure 10-3. If your alternator appears significantly different from the one shown, refer to your vehicle service manual.
3. When alternator testing is complete, follow the reassembly instructions in your vehicle service manual carefully. Be especially careful with the alternator brushes. They are brittle and can be damaged if proper re-assembly procedures are not followed.
4. Tension the alternator belt properly.

WARNING

The alternator output terminal is connected to the Positive (+) battery terminal at all times, even with the ignition key off. Always disconnect the Negative (-) battery cable from the battery **before** disconnecting and removing the alternator from the vehicle to avoid component/vehicle damage and possible personal injury.



Disassembled Alternator (GM AC Delco shown)
Figure 10-3

Table 10-2

Manufacturer	Spark Plug Wire Resistance	Coil Tower Wire Resistance
Chrysler Corporation	Less than 50,000 ohms	Less than 15,000 ohms
Ford Motor Company	All wires less than 5000 ohms ohms per inch	
General Motors Corporation	0" to 15" wires–3000 ohms to 10,000 ohms 15" to 25" wires–4000 ohms to 15,000 ohms 25" to 35" wires–6000 ohms to 20,000 ohms	

5. For safety reasons, the Negative (-) battery cable should be the last connection made after the rest of the installation is complete.

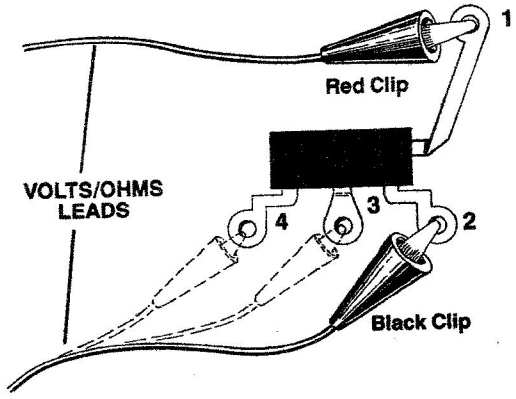
10-5. Rectifier Diode Tests.

A. Hookup Procedure:
1. Press the DIGITAL POWER (9) ON.
2. Insert the WHITE VOLTS/OHMS (14) connector into its WHITE socket on the Analyzer.
3. Set the DIGITAL FUNCTION SELECTOR (7) to Ohms.
4. Set the DIGITAL RANGE SELECTOR (8) to 2 K Ohms.

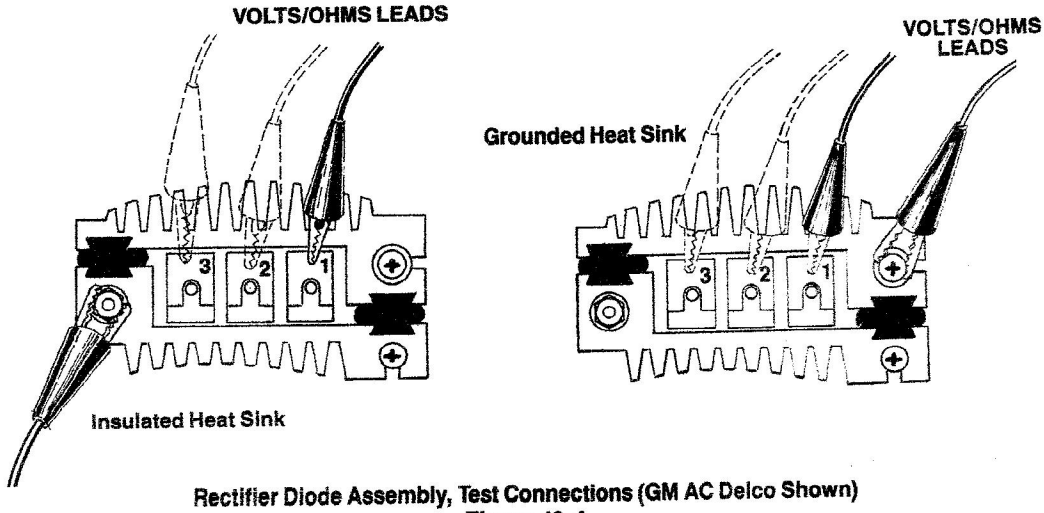
B. Test Procedure, Rectifier Diodes:
1. See Figure 10-4 before beginning this test. Make all connections to a clean metal surface. Clean the metal surface if necessary. If the figure below does not match your alternator, refer to your vehicle service manual.
2. Connect the BLACK clip to the insulated heat sink. In sequence, press the RED clip on the top spade terminal (not the threaded stud) at points 1, 2, and 3. (The insulated heat sink is connected to the alternator output terminal.) Record each reading from the DIGITAL DISPLAY(6).
3. Connect the RED clip to the insulated heat sink. In sequence press the BLACK clip on the top spade terminal (not the threaded stud) at points 1, 2, and 3. Record each reading from the DIGITAL DISPLAY (6).
4. Connect the BLACK clip to the grounded heat sink. In sequence, press the RED clip on the top spade terminal (not the threaded stud) at points 1, 2, and 3. Record each reading from the DIGITAL DISPLAY (6).
5. Connect the RED clip to the grounded heat sink. In sequence, press the BLACK clip on the top spade terminal (not the threaded stud) at points 1, 2, and 3. Record each reading from the DIGITAL DISPLAY (6).
6. After all 12 readings are recorded, press the DIGITAL POWER (9) OFF if testing is complete.

C. Test Procedure, Diode Trio (Delco-Remy AC Generators): Delco-Remy generators use a diode trio in their AC generators. This kind of diode package has four connectors. See Figure 10-5 for test point connections.
1. Connect the RED clip to connector 1 and the BLACK clip to connector 2. Record the reading on the DIGITAL DISPLAY (6). See Figure 10-5
2. Reverse the clips and record the reading on the DIGITAL DISPLAY (6). See Figure 10-5
3. Repeat Steps 1 and 2 for points 1 and 3 and 1 and 4. See Figure 10-5
4. Press the DIGITAL POWER (9) OFF if testing is complete.

D. Test Results, Rectifier Diode and Diode Trio Tests:
1. Normal
Each diode should show one high and one low reading at each connection point. The high reading should be infinity (1.). The low reading will be typically some three digit number on the display (.524). The actual number is not critical.



AC Delco Diode Trio Test Connections
Figure 10-5



Rectifier Diode Assembly, Test Connections (GM AC Delco Shown)
Figure 10-4

NOTE-RECTIFIER DIODES ONLY

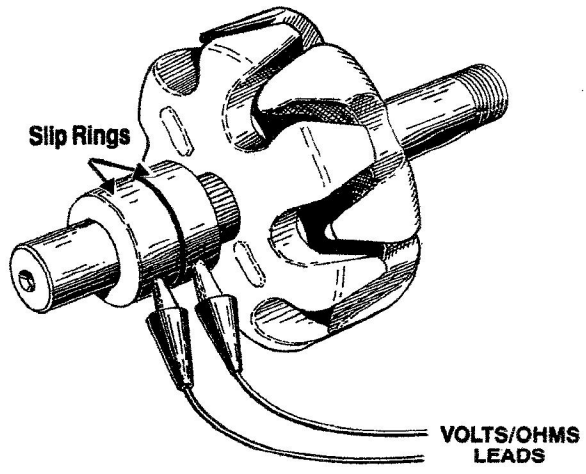
Three of the diodes tested will produce the low reading with the clips connected one way; the other three diodes will produce the low reading with the clips connected the opposite way.

2. Abnormal
   a. Open Diode. Both readings at each connection point are infinity (1.).
   b. Shorted Diode. Either or both readings are (.000) at each connection point.
   c. Leaky Diode. One reading is higher than the other but not infinity at each connection point (with the DIGITAL RANGE SELECTOR in the 2 K-Ohms position).

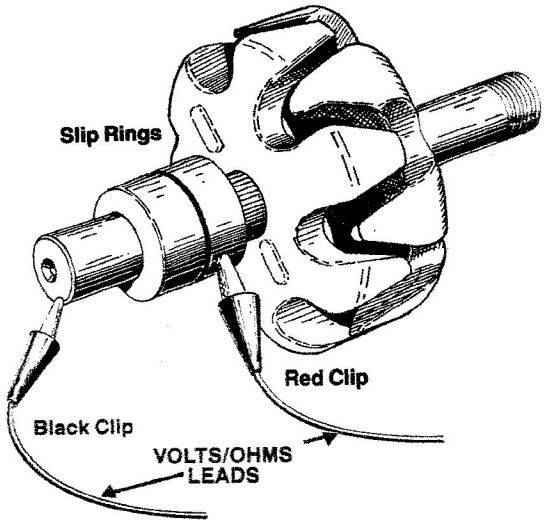
10-6. Rotor Tests (Alternator Field Coil). The alternator rotor can be tested for opens or shorts. If the ALTERNATOR CONDITION and ALTERNATOR OUTPUT TESTS presented earlier in this manual have indicated the possibility of a defective field winding, this test will positively identify it.

A. Hookup Procedure:
   1. Press the DIGITAL POWER (9) ON.
   2. Insert the WHITE VOLTS/OHMS (14) connector into the WHITE socket on the Analyzer.
   3. Set the DIGITAL FUNCTION SELECTOR (7) to Ohms.
   4. Set the DIGITAL RANGE SELECTOR (8) to 200 Ohms.

B. Test Procedure:
   1. Touch the RED clip to one of the slip rings and the BLACK clip to the other slip ring. See Figure 10-6
   2. Record the reading on the DIGITAL DISPLAY (6).
   3. Touch the RED clip to either slip ring and the BLACK clip to the rotor shaft. See Figure 10-7



Rotor (Field Coil) Test for Continuity
Figure 10-6



Rotor (Field Coil) Test, Short to Frame
Figure 10-7

4. Record the reading on the DIGITAL DISPLAY (6).
5. Press the DIGITAL POWER (9) OFF if testing is complete.

C. Test Results:
   1. Normal

NOTE

Remember to subtract the Analyzer's lead resistance as described earlier in this OHMMETER section of the manual.

   a. The Step 2 reading should be low, but NOT 0. Typical field winding resistance is about 1.5 to 3.5 ohms. See your vehicle service manual for exact specifications.
   b. The Step 4 (B. Test Procedure) reading should be infinity (1.).
   2. Abnormal

   a. Step 2
      1) Any reading below approximately 1.5 ohms indicates a shorted field winding, and it must be replaced or repaired in accordance with the vehicle service manual.
      2) Any reading above vehicle service manual specifications (typically 4 to 5 ohms) indicates a defective field winding. The field winding must be repaired or replaced in accordance with the vehicle service manual procedures.
      3) A reading of infinity (1.) indicates an open field winding which must be replaced according to vehicle service manual procedures.
   b. Step 4
      Any reading other than infinity (1.) especially a reading close to zero (000) indicates a winding

which is shorted to ground and must be repaired or replaced in accordance with the vehicle service manual.

10-7. Stator Tests The three stator windings can be checked for opens or shorts. If the ALTERNATOR CONDITION and ALTERNATOR OUTPUT TESTS presented earlier in this manual have indicated a possibility of a defective alternator, the procedure outlined below will check the condition of the stator windings.

NOTE

There are two types of winding methods used in modern alternator stators, the *wye* wound type and the *delta* wound type. Because of the winding configuration used in the delta wound type, this winding cannot be checked for continuity using the ohmmeter method. A special tester is required. Your vehicle service manual will indicate the type of winding used in your alternator. Typically, delta wound stators are used in high output alternators and for heavy duty applications.

A. Preparation:
Visually inspect the stator assembly windings for signs of overheating, usually caused by a shorted winding. Examine the varnish (insulation) on the windings. A severely blackened or charred appearance (often accompanied by a strong burnt smell) indicates that the varnish burned off the windings and is very likely shorted. In this case, the stator assembly must be repaired or replaced. Proceed with the electrical checks below.

B. Hookup Procedure:
1. Press the DIGITAL POWER (9) ON.
2. Insert the WHITE VOLTS/OHMS (14) connector into the WHITE socket on the Analyzer.
3. Set the DIGITAL FUNCTION SELECTOR (7) to Ohms.
4. Set the DIGITAL RANGE SELECTOR (8) to 200 Ohms.

C. Test Procedure:
1. Connect the RED and BLACK test clips between each pair of stator windings as shown in Figure 10-8 (RED clip on A, BLACK clip on B, then move the BLACK clip to C.)
2. Record each reading on the DIGITAL DISPLAY (6).
3. Set the DIGITAL RANGE SELECTOR (8) to 2 K Ohms.
4. Connect the BLACK clip to a clean area on the stator laminations (frame). See Figure 10-9
5. Connect the RED clip to one of the three stator leads. See Figure 10-9.
6. Record the reading on the DIGITAL DISPLAY (6).
7. Press the DIGITAL POWER (9) OFF if testing is complete.

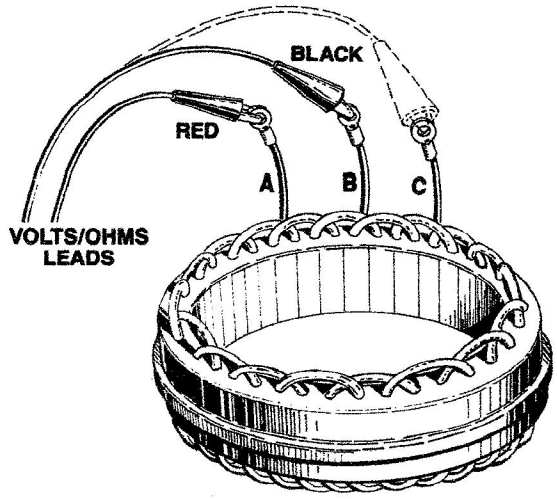
D. Test Results:
1. Normal

NOTE

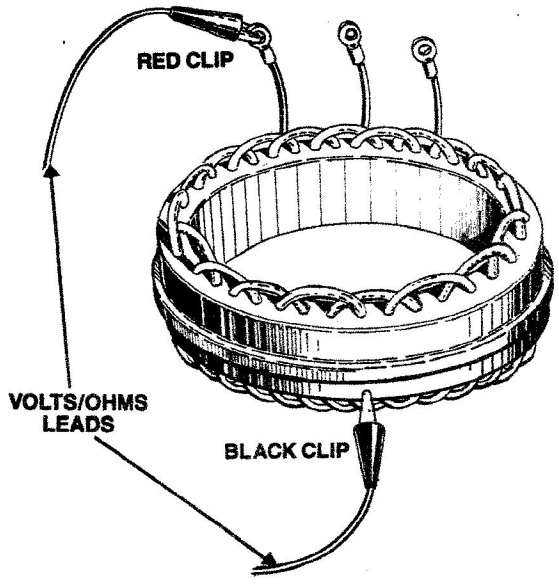
Remember to subtract the Analyzer's lead resistance as described earlier in the OHMMETER section of the manual.

a. Step 2
Each reading should be "continuity", very close to zero (000) ohms.

b. Step 6
Each reading should show infinity (1.).



Stator Windings, Test for Continuity
Figure 10-8



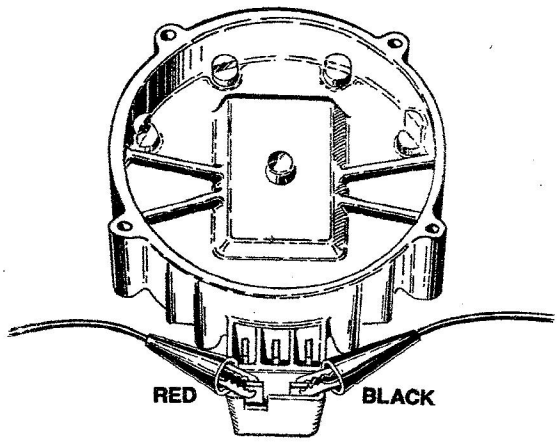
Stator Windings Test, Short to Frame
Figure 10-9

2. Abnormal
   a. Step 2
      If either of the readings shows more than a few ohms of resistance or shows infinity (1.), the stator assembly is defective and must be repaired or replaced in accordance with the vehicle service manual.
   b. Step 6
      If the reading shows anything other than infinity (1.) on the 2 K Ohms scale, it indicates that one or more of the stator windings is shorted to ground. The stator assembly must be repaired or replaced in accordance with the vehicle service manual.

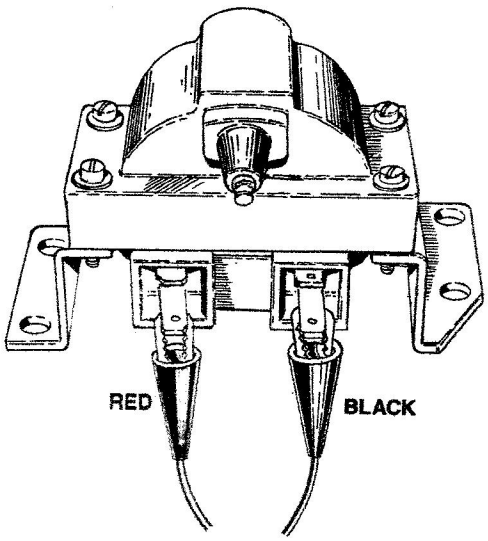
10-8. Ignition Coil Testing. The Ignition Coil consists of two windings of wire. The primary winding has relatively few turns of moderately heavy wire; its resistance will be low. The secondary winding has many turns of fine wire, and its resistance will be high. The OHMMETER can be used to check both the primary and secondary windings of the ignition coil as well as check for shorts to the case of the coil when indicated.

A. Hookup Procedure, Primary and Secondary Winding Checks:
   1. Press the DIGITAL POWER (9) ON.
   2. Insert the WHITE VOLTS/OHMS (14) connector into the WHITE socket on the Analyzer.
   3. Set the DIGITAL FUNCTION SELECTOR (7) to OHMS.
   4. Set the DIGITAL RANGE SELECTOR (8) to 200 OHMS for the primary Winding Check or to 200 K OHMS for the Secondary Winding Check.

B. Test Procedure:
   1. For the Primary Winding Check connect the BLACK and RED clips to the primary winding as shown in Figures 10-10, 10-11, 10-12, and 10-13.

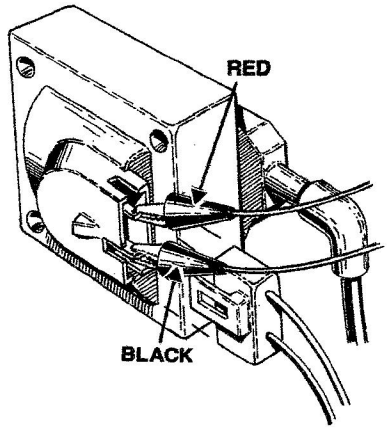


HEI Integral Coil, Primary Winding, Volts/Ohms Clips
Figure 10-10



HEI External Coil, Primary Winding, Volts/Ohms Clips
Figure 10-11

   2. For the Secondary Winding Check, connect the BLACK and RED clips to the secondary winding as shown in Figures 10-14, 10-15, 10-16, and 10-17.
   3. Record the readings as shown on the DIGITAL DISPLAY (6).

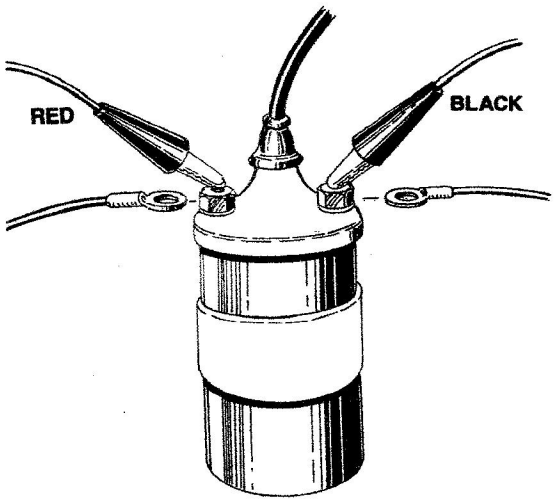


Ford TFI, Primary Winding, Volts/Ohms Clips
Figure 10-12

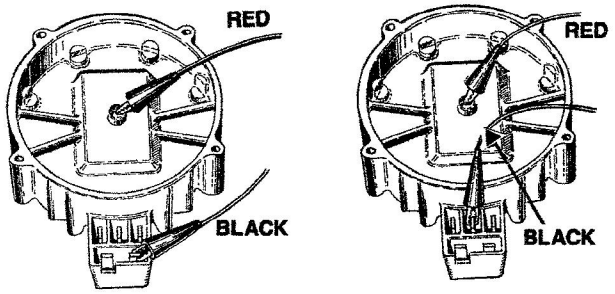
C. Test Results:

NOTE

Be sure to subtract lead resistance from the reading as described in chapter 10, Low Resistance Measurements for Primary Coil measurements.

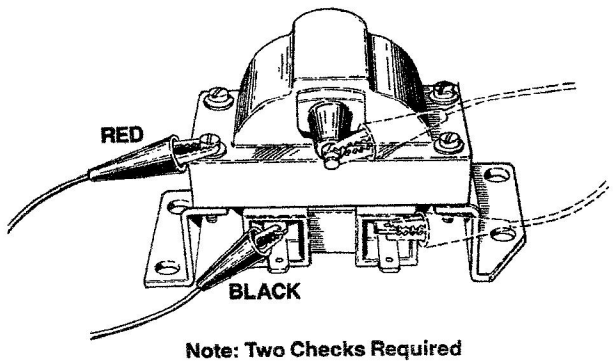


Cylindrical Coil, Primary Winding, Volts/Ohms Clips
Figure 10-13



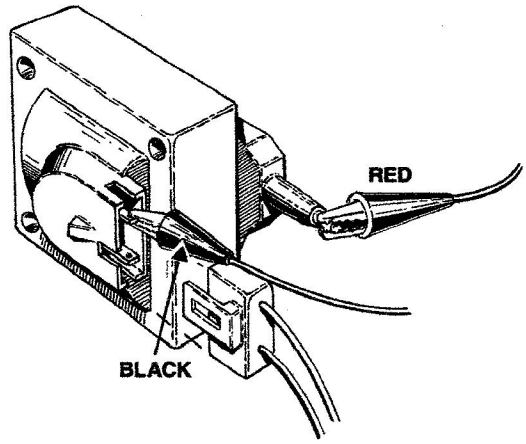
Note: Two Checks Required

HEI Integral Coil, Secondary Winding, Volts/Ohms Clips
Figure 10-14

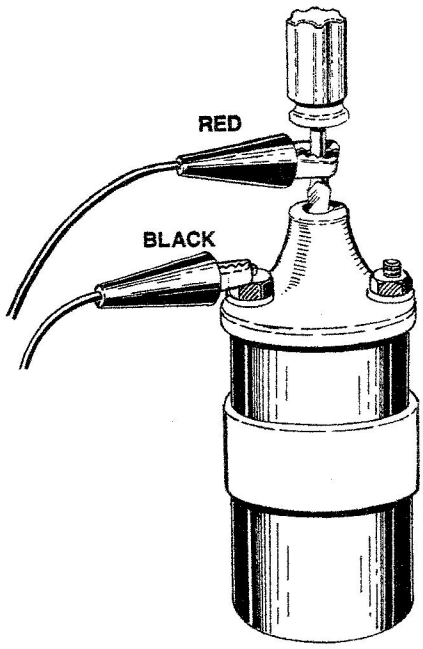


Note: Two Checks Required

HEI External Coil, Secondary Winding, Volts/Ohms Clips
Figure 10-15



Ford TFI, Secondary Winding, Volts/Ohms Clips
Figure 10-16



Cylindrical Coil, Secondary Winding, Volts/Ohms Clips
Figure 10-17

1. Normal
   a. Primary winding reading is within manufacturer's specifications. If specifications are not available, TABLE 10-3 may be used as a guide.
   b. Secondary Winding reading is within manufacturer's specifications. If specifications are not available, TABLE 10-4 may be used as a guide.
2. Abnormal
   a. Primary Winding resistance value is not within manufacturer's specifications.
      1) Shorted--00.0 (except HEI)
      2) Open--infinity (1)
      3) Out of tolerance, either high or low resistance

TABLE 10-3

Manufacturer	Resistance
Delco-Remy HEI (All)	Zero or close to zero (typically 00.3 - 00.6 ohms)
Chrysler Corporation	
Prestolite	01.6 - 01.8 ohms
Echlin or Essex	01.3 - 01.6 ohms
Ford Motor Co.	
Duraspark II	00.8 - 01.2 ohms (Varies with model year)
TFI	00.3 - 01.0 ohms
Duraspark III	00.8 - 01.6 ohms

Table 10-4

Manufacturer	Resistance
Delco-Remy HEI (All)	High reading on 200 K Ohms scale (Replace only if both readings are infinity--1.)
Chrysler Corporation	
Prestolite	9400 - 11,700 ohms
Echlin or Essex	9000 - 12,200 ohms
Ford Motor Co.	
Duraspark II, III	7700 - 10,500 ohms varies with model year
TFI	8000 - 11,500 ohms

b. Secondary Winding resistance value is not within manufacturer's specifications.
   1) Shorted--00.0
   2) Open--infinity (1)
   3) Out of tolerance, either high or low resistance

10-9. Magnetic Pickup Coil Test. Some electronic ignition systems use a magnetic pickup coil and reluctor assembly in place of contact points. Faults in operation of this assembly may be determined by this test. This test is indicated when a no start, hard start, or "bucking when driving" condition is encountered.

CAUTION

HEI SYSTEMS: Because of various factors acting upon an ignition coil, the *direction* of the windings inside the ignition coil may differ from vehicle to vehicle. If the coil is defective and must be replaced, make certain that the correct coil is used for your vehicle. If the wrong coil is used, you may experience a hard start (excessive cranking time) or possibly a "crank but no start" condition.

CAUTION

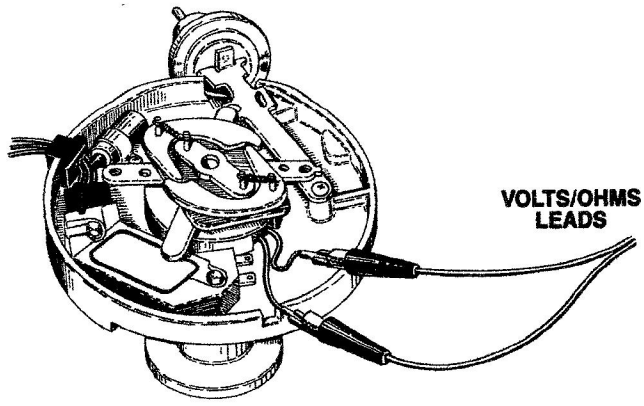
Do not allow OHMMETER test lead clips to touch each other or the vehicle ground.

A. Hookup Procedure, GM HEI Systems:

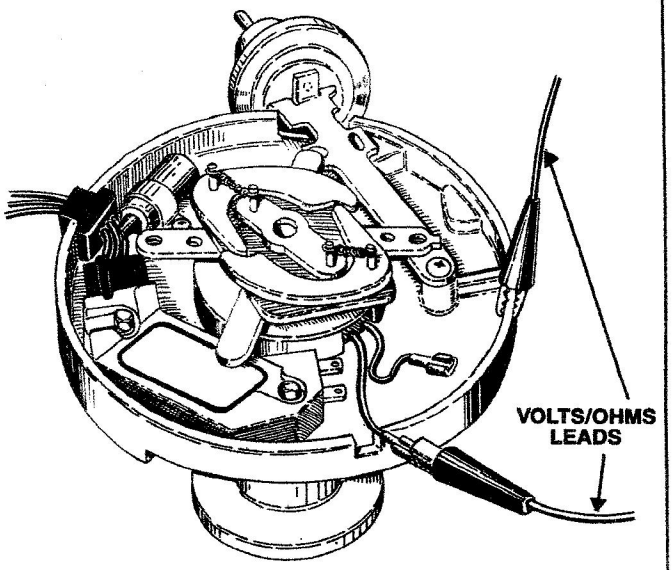
1. Press the DIGITAL POWER (9) ON.
2. Insert the WHITE VOLTS/OHMS (14) connector into the WHITE socket on the Analyzer.
3. Set the DIGITAL FUNCTION SELECTOR (7) to Ohms.
4. Set the DIGITAL RANGE SELECTOR (8) to 2 K Ohms.
5. Remove the distributor cap and rotor. If necessary for clearance on integral coil systems, remove distributor BAT lead and module connector at the distributor cap. To avoid damage to the rotor and high tension output contact in the cap, pull the cap straight up at least one inch before tipping to remove.
6. Disconnect the white and the green wires from the pickup coil side of the electronic module and connect the VOLTS/OHMS test clips to the wires as shown in Figure 10-18. In the case of the small modular connector, small nails may be needed for making connections as shown in Figure 10-20.

B. Test Procedure:

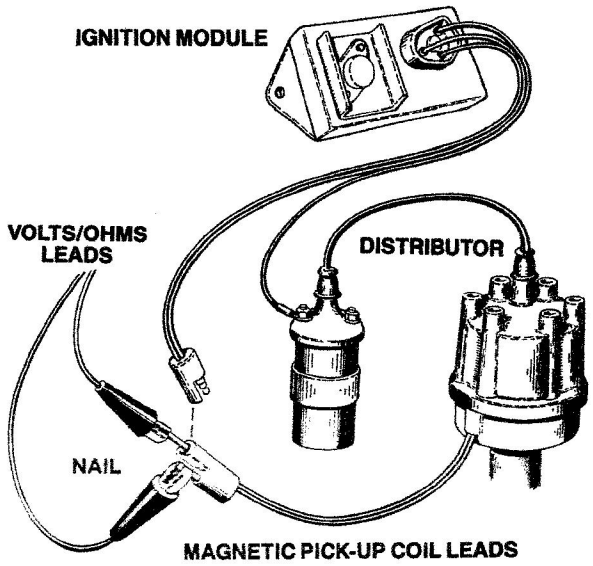
1. Gently wiggle or flex the green and white wires from the pickup coil while observing the DIGITAL DISPLAY (6). The DISPLAY should remain constant. If there is any sign of erratic operation (the DIGITAL DISPLAY flickers or changes reading significantly), check the pickup coil wires for insulation nicks, cuts or wear, and check the terminals for tight connections.
2. Record the reading on the DIGITAL DISPLAY (6).
3. Connect the RED clip to the green wire and the BLACK clip to the distributor housing as shown in Figure 10-19. Do not allow the white pickup coil lead to touch ground.
4. Record the reading on the DIGITAL DISPLAY (6).
5. Remove the test leads. Reconnect the green and



Magnetic Pickup Coil Test Hookup, Coil Resistance, HEI SYSTEM
Figure 10-18



Magnetic Pickup Coil Test Hookup, Short to Ground, HEI System
Figure 10-19



Magnetic Pickup Coil Test Hookup, Coil Resistance, Chrysler Systems
Figure 10-20

white wires to the electronic module.

6. Re-install the distributor cap. Reconnect all wires.
7. Press the the DIGITAL POWER (9) OFF if testing is complete.

C. Test Results:

1. Normal
   a. Step 2 reads 500 - 1500 ohms.
   b. Step 4 reads infinity (1.).
2. Abnormal
   a. Step 2. If the coil is either shorted (000) or open (1.), it is defective and must be replaced. If the reading shows erratic operation, replace the coil.
   b. Step 4. Any reading other than infinity (1.) indicates a shorted coil which must be replaced.

D. Hookup Procedure, Chrysler Electronic Systems (6 and 8 Cylinder Only):

CAUTION

Do not allow OHMMETER test lead clips to touch each other or the vehicle ground.

1. Press the DIGITAL POWER (9) ON.
2. Insert the WHITE VOLTS/OHMS (14) connector into the WHITE socket on the Analyzer.
3. Set the DIGITAL FUNCTION SELECTOR (7) to Ohms.

NOTE

Some Chrysler Electronic Ignition Systems use two pickup coils (Start and Run). Each of these coils may be tested separately using the same procedure.

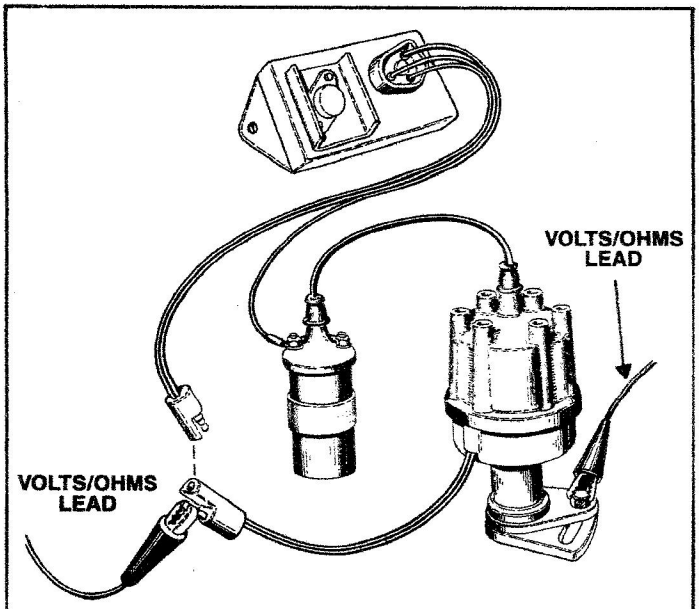
4. Set the DIGITAL RANGE SELECTOR (8) to 2 K Ohms.
5. Disconnect the two wire connector between the distributor and the electronic module.
6. Connect the OHMMETER test clips to the distributor side of the connector as shown in Figure 10-20.

E. Test Procedure:

1. Gently wiggle or flex the pickup coil wires their full length while observing the DIGITAL DISPLAY (6). The DIGITAL DISPLAY should remain constant. If there is any sign of erratic operation (the display flickers or changes readings significantly), check the pickup coil wires for insulation nicks, cuts, or wear, and check the terminals for good connections.
2. Record the reading on the DIGITAL DISPLAY (6).
3. Connect the RED clip to either of the pickup coil wires and the BLACK clip to a good ground as shown in Figure 10-21.
4. Record the reading on the DIGITAL DISPLAY (6).
5. Remove the test leads; reconnect the distributor harness to the engine harness.
6. Repeat the procedure on the second pickup coil (if equipped).
7. Press the DIGITAL POWER (9) OFF if testing is complete.

F. Test Results:

1. Normal
   a. Step 2 reads 150 to 900 ohms
   b. Step 4 reads infinity (1.).
2. Abnormal:
   a. Step 2. If the coil is either shorted (000) or open (1.), it is defective and must be replaced. If the reading shows erratic operation, replace the coil.
   b. Step 4. Any reading other than infinity (1.) indi-



Magnetic Pickup Coil Test Hookup, Short to Ground, Chrysler Systems
Figure 10-21

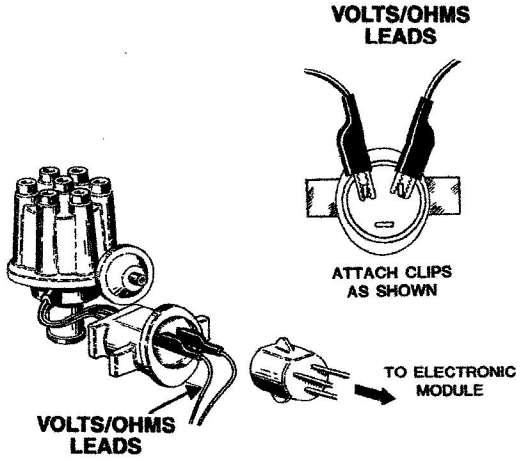
cates a coil which is shorted to ground and must be replaced.

G. Hookup Procedure, Ford SSI,DS I, DS II Systems:

CAUTION

Do not allow OHMMETER test lead clips to touch each other or the vehicle ground.

1. Press the DIGITAL POWER (9) ON.
2. Insert the WHITE VOLTS/OHMS (14) connector into the WHITE socket on the Analyzer.
3. Set the DIGITAL FUNCTION SELECTOR (7) to Ohms.
4. Set the DIGITAL RANGE SELECTOR (8) to 2 K Ohms.

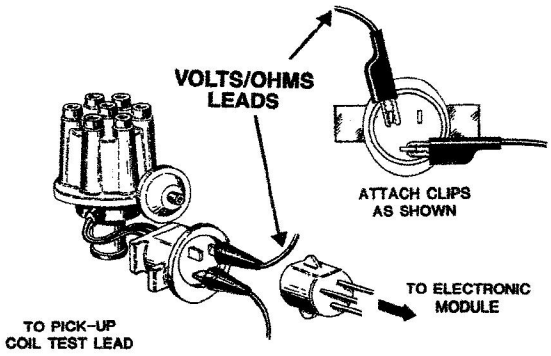


Magnetic Pickup Coil Test Hookup, Coil Resistance, Ford Systems
Figure 10-22

5. Disconnect the three wire connector between the distributor and the electronic module.
6. Connect the OHMMETER test clips to the distributor side of the connector as shown in Figure 10-22.

H. Test Procedure:

1. Gently wiggle or flex the pickup coil wires their full length while observing the DIGITAL DISPLAY (6). The DIGITAL DISPLAY should remain constant. If there is any sign of erratic operation (the display flickers or changes reading significantly), check the pickup coil wires for insulation nicks, cuts, or wear, and check the terminals for good connections.
2. Record the reading on the DIGITAL DISPLAY (6).
3. Connect the RED clip to the purple or orange wire and the BLACK clip to a good ground as shown in Figure 10-23.



Magnetic Pickup Coil Test Hookup, Short to Ground, Ford Systems
Figure 10-23

4. Set the DIGITAL RANGE SELECTOR (8) to 200 K Ohms.
5. Record the reading on the DIGITAL DISPLAY (6).
6. Remove the test leads; reconnect the distributor harness to the engine harness.
7. Press the DIGITAL POWER (9) OFF if testing is complete.

I. Test Results:

1. Normal. See the table below.

Table 10-5.
Magnetic Pickup Coil Resistance Values

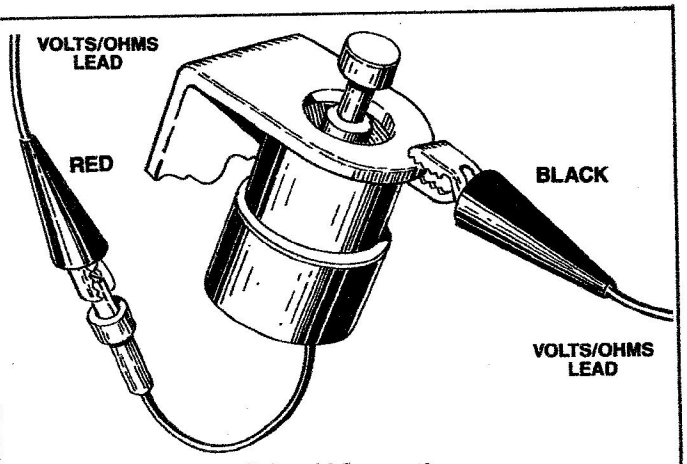
Purple to Orange:	Purple or Orange to Ground:
SSI 1974-1976 = 400 - 800Ω	greater than 70,000Ω
DS-1, DS-II = 400 - 1000Ω	greater than 70,000Ω
DS-II, ESCORT/LYNX = 650 - 1300Ω	greater than 70,000Ω

2. Abnormal
   Any results obtained other than those shown in the above table are abnormal. Check the pickup coil/ wiring and replace in accordance with the vehicle service manual if necessary.

10-10. Testing Solenoids. The modern vehicle uses a number of solenoids that may require testing. The basic purpose of the solenoid is to convert an electrical signal into mechanical movement. The throttle kicking solenoid is one example of the major uses of solenoids. (See Chapter 9, "Carburetor Adjustments" to adjust these solenoids.) Solenoids are used extensively in today's computer controlled vehicles in a variety of applications. Your OHMMETER can be used to electrically check solenoids in accordance with your vehicle service manual. One example is given below.

A. Hookup Procedure:
   1. Press the DIGITAL POWER (9) ON.
   2. Insert the WHITE VOLTS/OHMS (14) connector into the WHITE socket on the Analyzer.
   3. Set the DIGITAL FUNCTION SELECTOR (7) to Ohms.
   4. Set the DIGITAL RANGE SELECTOR (8) to 200 Ohms.

B. Test Procedure:
   1. Connect the RED VOLTS/OHMS clip to the pigtail connector of the solenoid and the BLACK VOLTS/ OHMS clip to the body of the solenoid as shown in Figure 10-24.



Solenoid Connections
Figure 10-24

   2. Record the reading on the DIGITAL DISPLAY (6).

> **NOTE**
>
> If the DIGITAL DISPLAY reads over range (1.), switch the DIGITAL RANGE SELECTOR to 2 K Ohms.

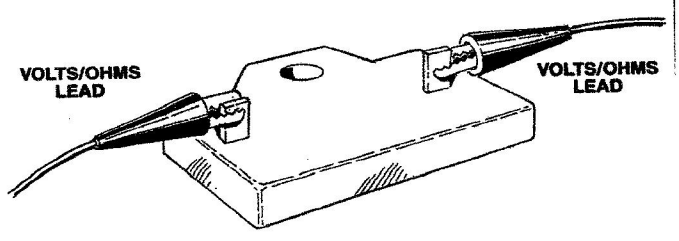
C. Test Results:
   1. Normal
      Readings are within manufacturer's specification. (Solenoids used in automotive applications are typically low in resistance value, usually less than 200 ohms. Consult your vehicle service manual for exact values.)
   2. Abnormal
      The abnormal test results listed below will direct you to the most likely problem areas. These test results may indicate a defect in the vehicle. Consult your vehicle service manual for the proper procedures to check these problem areas.
      a. Resistance value is out of specification.
      b. The resistance reading indicates an open (1.) solenoid.

10-11. Ballast Resistor Testing. The purpose of the ballast resistor (when equipped) is to limit the current available to the ignition coil when the vehicle is running. Failure of this resistor results in a dead engine. If the engine trys to start when cranking but stops when the key is released, then the ballast resistor may be "open".

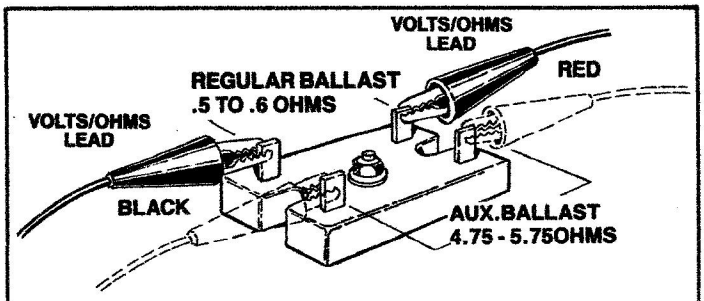
A. Preparation:
   With the ignition key OFF, locate the ballast resistor and remove all leads at their terminals to prevent possible damage to the Analyzer and to prevent measurement of other circuits connected to it. The ballast resistor is usually a white ceramic block with brass terminals located on the firewall. If you have difficulty locating the vehicle's ballast resistor, consult the vehicle service manual. On some Ford Motor Company systems the ballast resistor is a length of resistance wire incorporated in the engine harness. Consult your vehicle service manual for location and resistance value.

B. Hookup Procedure:
   1. Press the DIGITAL POWER (9) ON.
   2. Insert the WHITE VOLTS/OHMS (14) connector into the WHITE socket on the Analyzer.
   3. Set the DIGITAL FUNCTION SELECTOR (7) to Ohms.
   4. Set the DIGITAL RANGE SELECTOR (8) to 200 Ohms.

C. Test Procedure:
   1. Clamp the RED and BLACK test clips to the terminals on the ballast resistor as shown in Figure 10-25



Typical Ballast Resistor Connections
Figure 10-25



Chrysler Dual Ballast Resistor Test
Figure 10-26

NOTE

Many Chrysler Corporation electronic ignition systems use a dual ballast resistor. Test both sides of this unit as shown in Figure 10-26.

2. Record reading(s) on the DIGITAL DISPLAY (6).
3. Remove the test leads and reconnect all wires disconnected in the Preparation Step.
4. Press the DIGITAL POWER (9) OFF if testing is complete.

D. Test Results:

NOTE

Be sure to subtract lead resistance from the reading as described in Chapter 10, Low Resistance Measurements.

1. Normal
   Resistance values are within manufacturer's specifications. These are typically low values between .5 and 5 ohms.
2. Abnormal
   The abnormal test results listed below will direct you to the most likely problem areas. These test results may indicate a defect in the vehicle. Consult your vehicle service manual for the proper procedures to check these problem areas.
   a. Resistance values are out of specification. Consult your vehicle service manual for specifications.
   b. The reading(s) indicates an open ballast resistor.

APPENDIX A.

ENGINE TIMING

Timing adjustments require a timing light. Select a Sears Craftsman Model 2194 (advance timing light) or a Model 2134 which are both accurate to 8000 RPM. The Model 2194 Advance Timing Light has the capability of measuring not only initial timing but also checking the calibration of the various timing advance circuits which are critical to fuel economy and engine performance. Sears also offers the Model 21174 (accurate to 6000 RPM) and the Model 21684 (accurate to 4000 RPM) for less demanding applications. Follow the instructions included with the Timing Light regarding its use. Consult your vehicle emission control label (located in the engine compartment) or your vehicle service manual for exact instructions on timing your vehicle. Since timing must be adjusted at a specified RPM, the Sears 21045 Analyzer is a necessary tool to help the technician set and monitor engine speed. Follow the procedure below.

HOOKUP PROCEDURE:

Figure 2-2 shows a hookup procedure for most of the leads on the Sears 21045 Analyzer. Only the test leads listed below are required for the Engine Timing Procedure although the other leads may remain connected.

1. Insert the BLACK 3 pin POWER/POINTS/DWELL/C-3 (11) connector in the 3 pin BLACK socket on the Analyzer. Connect the RED clip to the Positive (+) battery terminal and the BLACK clip to a secure ground connection on the engine, frame, or alternator bracket. The BLACK clip should be the last connection made and the first to be disconnected. (The GREEN clip is not used for this test.)

WARNING

Avoid connecting the BLACK POWER clip directly to the battery Negative (-) terminal in the event that hydrogen gases are present which could explode from sparking connections.

2. Insert the BLUE RPM (13) connector into the BLUE socket of the Analyzer. Clamp the RPM pickup around the No. 1 spark plug wire. The clamp must completely enclose the spark plug wire. See Figure 7-2.

PRO-TIP

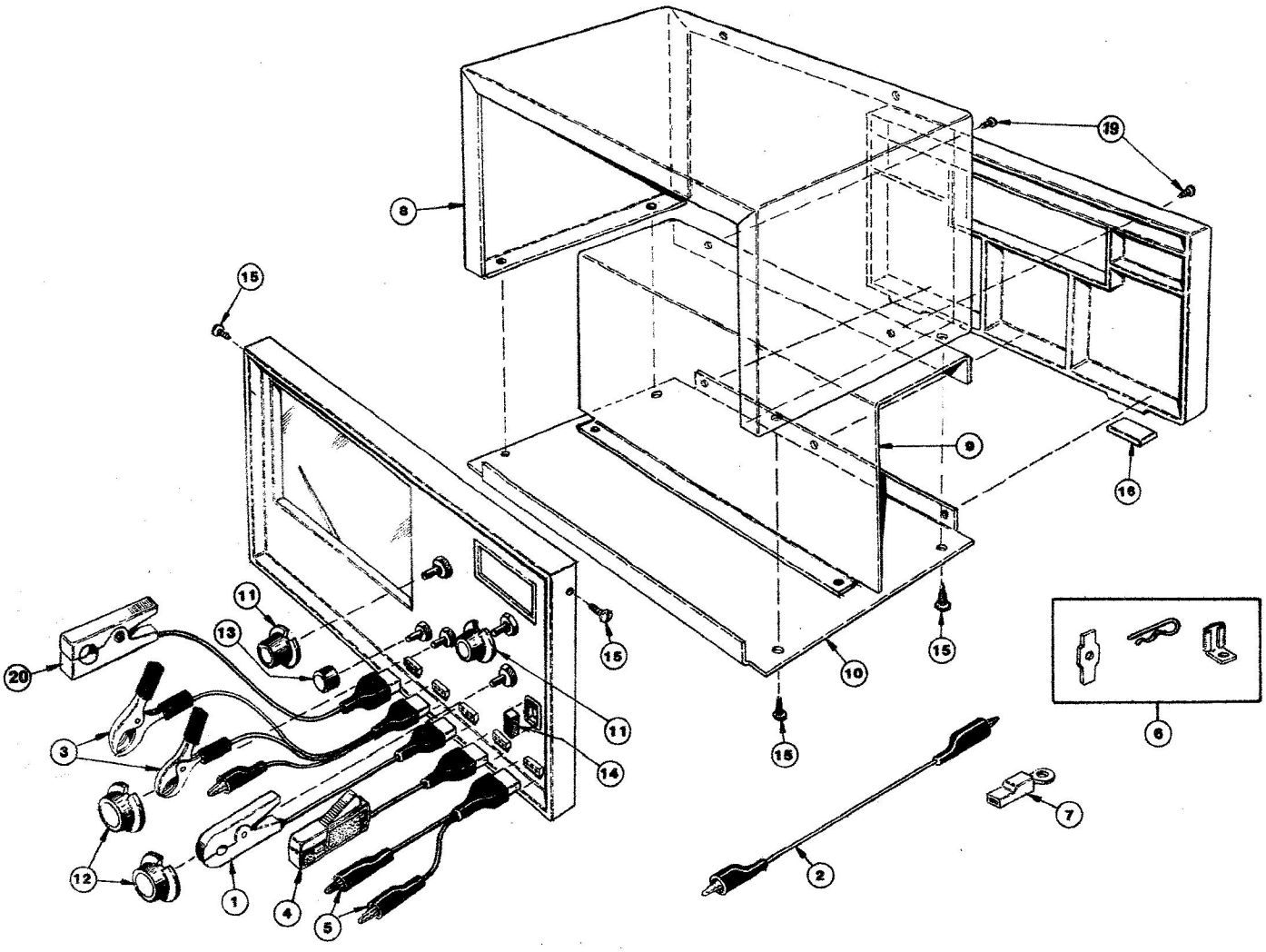
A defective ignition system may cause the tachometer to bounce around or show unsteady and intermittent readings. Low output spark voltage or defective ignition wires may be responsible. You may be able to steady the reading by sliding the RPM pickup along the ignition wire to a new location, or reversing the RPM pickup on the wires as shown in Figure 7-6. If erratic readings persist, move to another ignition wire in the event that the original one may be defective since the RPM pickup can be connected to any spark plug lead. Also, solid copper ignition wires radiate large amounts of radio frequency noise through the air which can interfere with the proper operation of the Analyzer and other electronic equipment. Replace solid copper ignition wire with resistance wire if only for the tests described in this manual.

3. Turn the ANALOG FUNCTION SELECTOR (4) to RPM and the ANALOG RANGE SELECTOR (3) to the appropriate scale as required by the Engine Timing Speed.

TEST PROCEDURE:

Follow the instructions given with your Timing Light and your vehicle service manual.

APPENDIX B.
REPLACEMENT PARTS DIAGRAM AND ORDERING INSTRUCTIONS



REPLACEMENT PARTS, SEARS 161.21045
Figure B-1

ENGINE ANALYZER

MODEL 161.21045

TABLE B-1

Key No.	Part No.	Description
1	10-104	Ignition Kilovolts Pickup
2	38-396	Jumper Lead
3	38-850	Power/Dwell/Points/C-3 Lead
4	38-853	RPM Pickup
5	38-855	Volts/Ohms Lead
6	1000-425	Accessory Kit
7	1000-248	Alternator Adapter
8	180-797	Top and Side Metal Cover
9	7-0024	Baffle Assembly
10	180-799	Bottom
11	450-144	Range Selector Knob (2)
12	450-145	Function Selector Knob (2)
13	450-146	Amps Zero Adjustment Knob
14	450-147	Power Switch Knob
15	270-130	6-20 x 3/8 Phillips Head Black Screw (12)
16	400-1058	Pad (Foot) (4)
17	2-177701	Instruction Manual (Not Illustrated)
18	1000-1335	Complete Accessory Kit (Includes Key Numbers 1-7)
19	270-154	6-20 x 5/8 Phillips Head Black Screw (5)
20	38-848	(See NOTE Below) Amps/Alternator Pickup

NOTE: The Amps/Alternator pickup can be replaced but must be calibrated with your Analyzer. Contact your Nearest Sears Service Center or Sears store for additional information.

All parts listed may be ordered from any Sears, Roebuck and Company store or service center.

WHEN ORDERING REPAIR PARTS, ALWAYS GIVE THE FOLLOWING INFORMATION:

1. PART NUMBER (Above)
2. MODEL NUMBER 161.21045
3. PART DESCRIPTION (Above)
4. NAME OF ITEM—ENGINE ANALYZER

If the parts you need are not stocked locally, your order will be electronically transmitted to a Sears Repair Parts Distribution Center for expedited handling.