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**42-210**

**Alternator, Regulator, Battery, Starter Tester**

# **Operating & Maintenance Instructions**



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# Safety Precautions

## WARNING!

- **BATTERIES PRODUCE EXPLOSIVE GASES.** Provide for adequate ventilation. Keep lighted cigarettes, sparks, flames and other ignition sources away from battery.
- **BATTERIES CONTAIN SULFURIC ACID WHICH IS POISONOUS AND CAUSES SEVERE BURNS.** Avoid contact and have water available for flushing.
- **WEAR SAFETY GOGGLES WHEN WORKING ON OR AROUND BATTERIES.**
- **STAND BACK FROM BATTERY DURING TESTING.**
- **DO NOT REMOVE LEADS WHILE BATTERY TEST IS RUNNING.** If a lead must be removed during a test, first press [OFF] or any test key to abort.

 **Caution:** Before disconnecting battery cables to remove battery from a vehicle, carefully follow these steps:

1. Be sure ignition is "OFF."
2. Turn all accessories and loads "OFF" and close the door.
3. Remove NEGATIVE (-) battery cable first. Failure to follow the above steps before removing battery will result in damage to the vehicle computer system.

**IMPORTANT NOTE:** This tester is designed to test 12-volt automotive batteries rated at 100 CCA or higher. Do NOT attempt to test 6-volt automotive batteries or small 12-volt, lawn mower-type batteries.

# Test Flowcharts

For a comprehensive electrical system test, run the following tests in order:

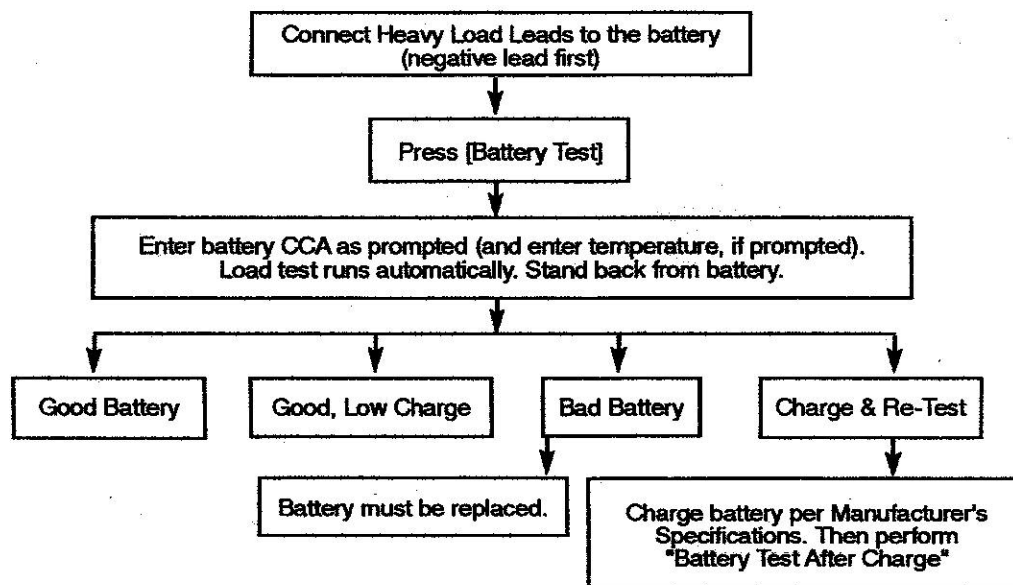
1. Battery Test
2. Starting Test
3. Charging Test

The following flowcharts help guide you through the tests. Refer to sections in this manual for more detailed instructions.

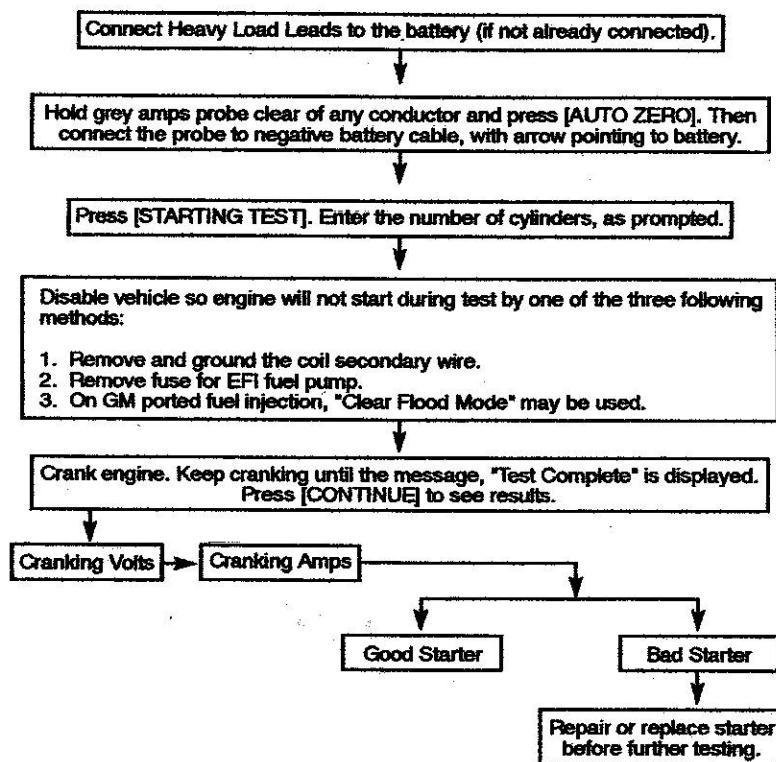
## BEFORE TESTING:

1. Make sure the vehicle battery cables and terminals are clean. Wire brush them if necessary.
2. Inspect the following and repair any problems before testing:  
Belts, belt tension, battery cables, connections, battery hold down, battery condition, battery fluid level.

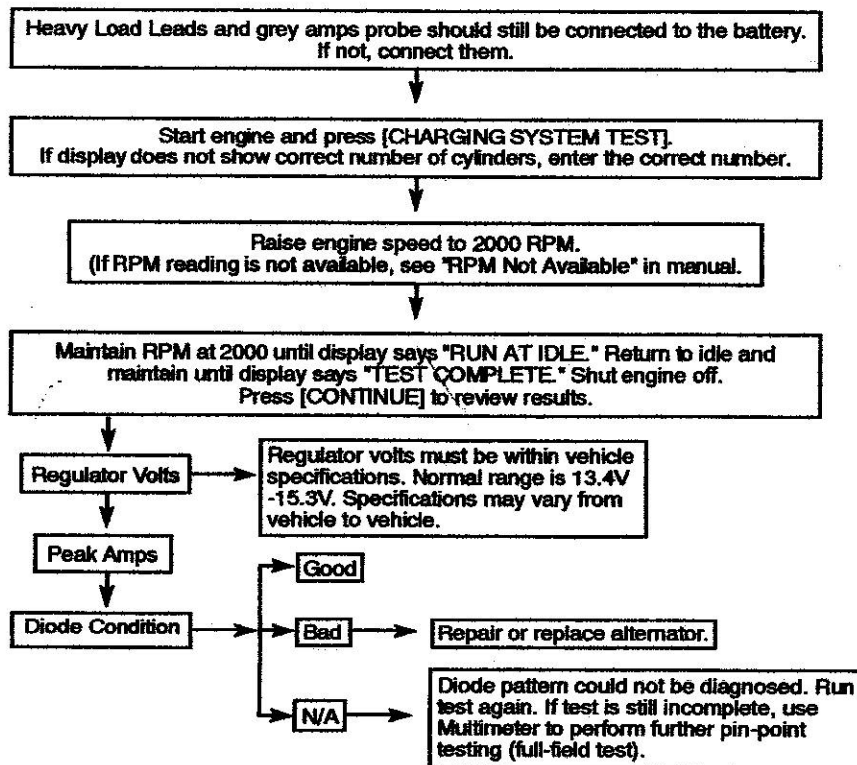
## Battery Test



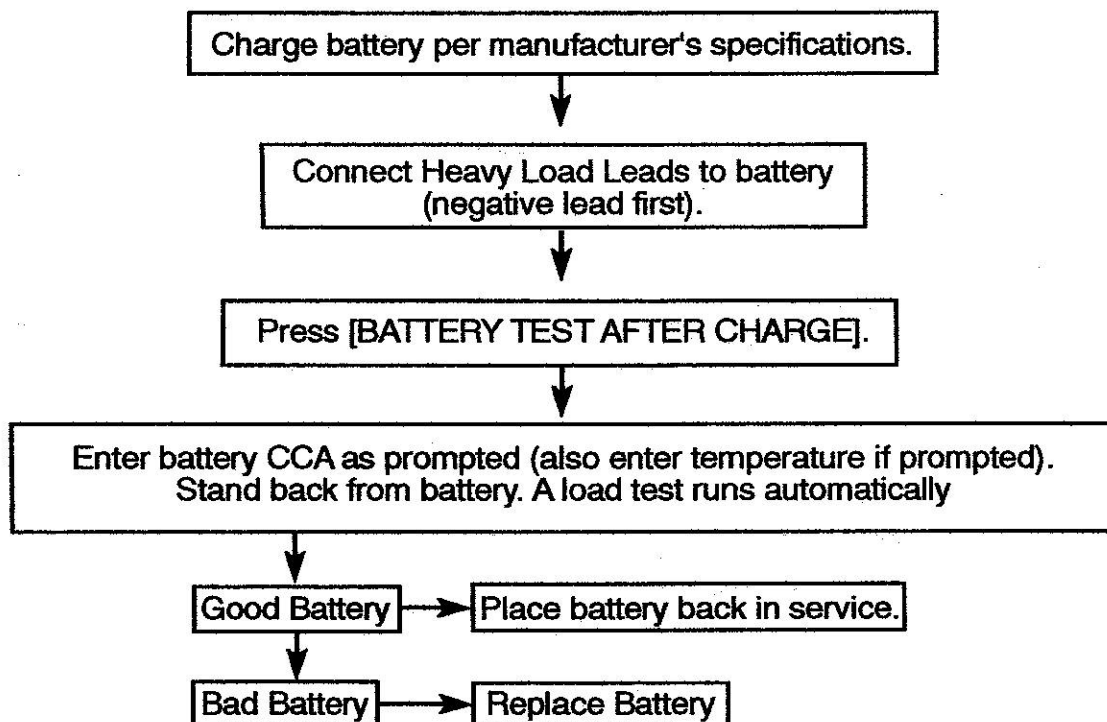
## Starting Test



## Charging System Test



## Battery Test After Charge



# Introduction

## Available Tests

The following is a summary of the test functions provided with the tester.

**Battery Test** - Automatic test to determine whether an automotive battery is "good," "bad," or requires charging.

**Starting Test** - Tests the condition of the starter to show cranking volts, cranking amps and whether the starter is "good" or "bad."

**Charging System Test** - Checks the charging system at high RPM and at idle to show regulator volts and peak amps. Indicates whether diodes are "good" or "bad."

**Battery Test after Charging** - This test can only be used on a battery that has already been tested once and has triggered the "Charge and Re-test" message. Battery must be fully charged according to the battery manufacturer's specifications before this test is performed. The procedure for testing after charging is the same as the Battery Test, except that the computer takes charging into consideration when it diagnoses the battery.

**Multi-Meter** - This function shows RPM, volt-meter readings, battery voltage and DC amps.

# Displays and Keypad

## Displays

There are three liquid crystal displays on the face of the tester (see Figure 1):

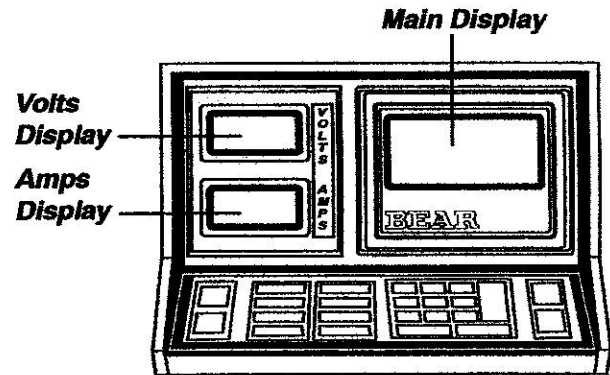


Figure 1

**Main Display** - (Green) - shows messages, information, and results for automatic tests as well as multimeter information.

**Volts Display** - (Top left) - shows battery voltage, as read through the battery load leads. Range is to +/- 40.00 DC Volts.

**Amps Display** - (Lower left) - shows current (amps), as read through the grey amps probe. Range is 0 to +/- 1000 Amps.

Amps readings are either negative or positive. A negative reading has a minus sign (-); a positive reading has no sign.

When the amps probe is hooked up to a vehicle (clamped around the vehicle's negative battery cable with the arrow pointing towards the battery), a negative reading indicates a battery drain; a positive reading indicates the battery is being charged.

## Keypad (Refer to Figure 2)

The tester emits a "beep" when a key is pressed and a command is accepted. The tester indicates an entry error has been made by emitting a longer, lower tone.

1. **POWER** keys - Used to turn the tester "ON" and "OFF." If the tester is not used for 15 minutes, it will automatically turn itself "OFF." (Test data will still be saved. See "Review Results" for details.)
2. **FUNCTION** keys - Used to select functions other than automatic tests.
3. **TEST SELECTION** keys - Used to select automatic tests.
4. **NUMERIC** keys; **CLEAR** and **ENTER** keys - Used to enter information, such as "number of cylinders," into the computer during testing.
5. **CONTINUE** key - Used during automatic testing to move from one screen or step to the next. The main display reads "<<CONT>>" when this key is active.
6. **LOAD ON/OFF** key - Used for manual battery load testing, this key applies and releases a battery load. (Load is automatically released after 15 seconds if unused.)

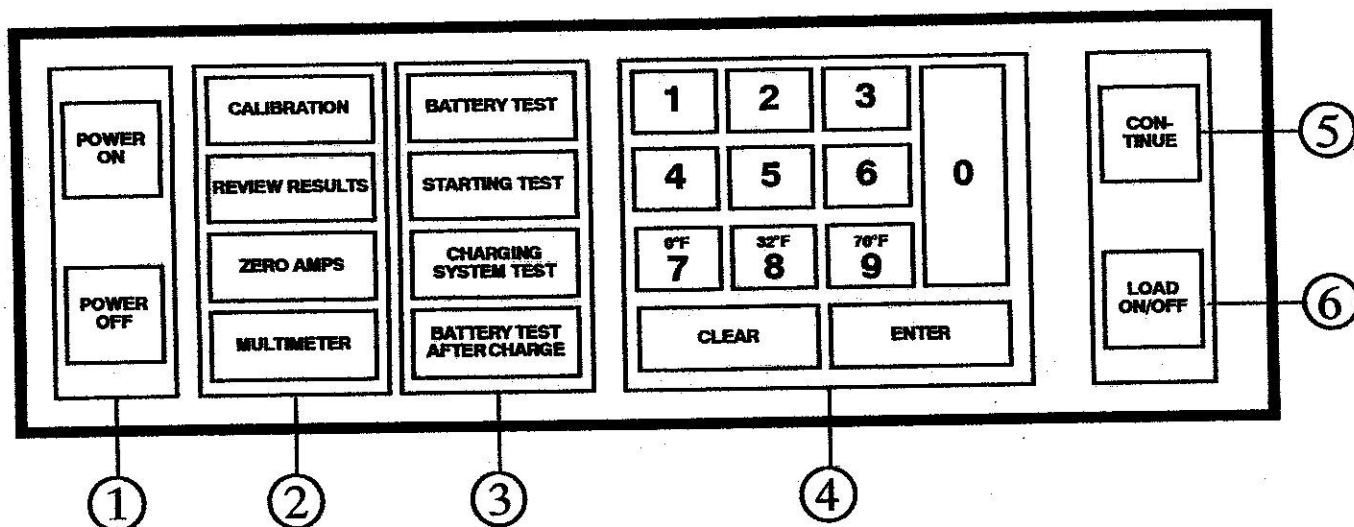


Figure 2

# Test Leads *(Refer to Figure 3)*

## Heavy Load Leads

The heavy load leads are used to read system voltage and to put a load on the battery during load tests. The computer's "battery tach" feature uses heavy load leads to read engine RPM. (**NOTE:** The red load lead has a temperature sensor which measures battery temperature.)

## Connections

1. Make sure battery cables and terminals are clean. Wire brush them if necessary.
2. Clamp the black (negative) load lead to the negative battery terminal.
3. Clamp the red (positive) load lead to the positive battery terminal.

## Grey Amps Probe

The grey amps probe is a "hall effect" lead used to read the current (amps) flowing through any conductor it is clamped around. During the starting and charging tests, the probe reads system amperage. The probe can also be used with the multimeter to read amps anywhere. The probe is not used for battery testing.

## Connections

Clamp the grey probe around the negative battery cable, making sure the arrow on the probe is pointing towards the battery. Also be sure the probe is around all wires running to the negative battery terminal connector.

"Zero Amps" procedure sets grey amps probe to zero.

## "Search Volts" Leads

The "search volts" leads are voltmeter leads, used to read "search volts" during multi-meter testing. Use the positive and negative voltmeter leads to read voltage drop between any two points in a circuit.

## Notes on Test Results

The results of the automatic tests are shown on the main display at the end of each test.

Results are also held in memory, even after the tester is turned "OFF." To review the latest results, press the "Review Results" key. (If the tester has been "OFF" since the latest test, press [Review Results] immediately after turning the tester "ON." If any other "Test Key" is pressed after turning tester back "ON," old results are lost.) See the "Review Results" section in this manual for complete details.

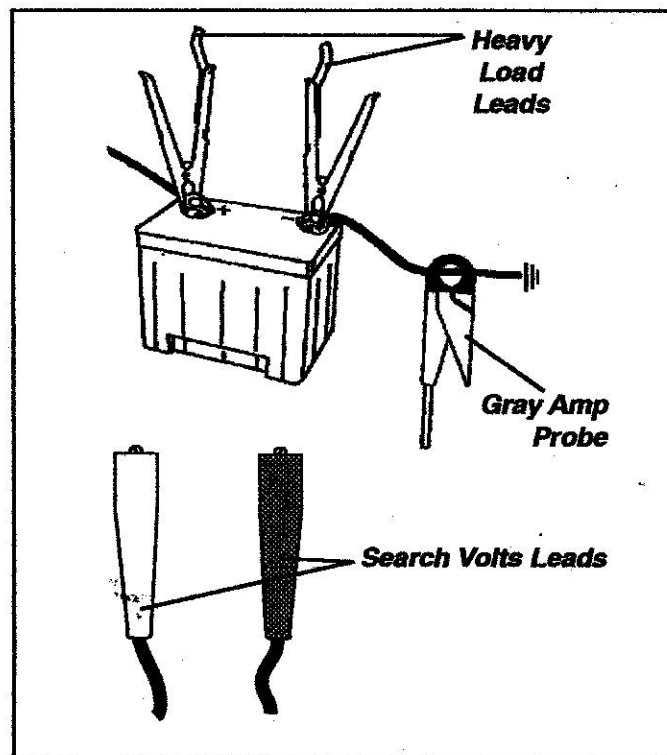


Figure 3



## **Battery Tachometer**

This tester is equipped with a battery tachometer that enables the tester to read engine RPM through the battery without having to connect a separate tachometer lead.

### **Battery Tachometer Limitations**

- Battery Tach range is 0 to 3000 RPM.
- When a load is applied to battery, or when certain battery conditions change, RPM readings may be temporarily interrupted. When this occurs, erratic RPM values may be displayed, or the display may read "N/A" in place of RPM. The readings normally recover after a few seconds, when battery condition stabilizes. Wait for readings to appear and stabilize before continuing.
- In unusual cases, the battery tachometer will not be able to get any RPM readings at all. This may happen under one of two conditions:
  1. The electrical systems on certain vehicles may operate outside the range of the battery tachometer.
  2. Certain alternator conditions may prevent the battery tachometer from getting a reading.

In either case, "N/A" will appear permanently on the display in place of engine RPM. When this occurs, wait 15 seconds to make sure "N/A" reading is permanent. If it is not, the tachometer readings are not available for the vehicle being tested. (**NOTE:** The Charging Test is the only automatic test affected by an "N/A" reading. There is an alternate procedure available which allows completion of a charging test when RPM is not available. (See the "Charging Test" section of this manual.)

## **Recharging**

- The tester is equipped with its own internal 6-volt battery and charger.
- The battery must be charged overnight AT LEAST once a week. The manufacturer recommends storing the tester on the charger every night.
- To save battery power, the tester automatically shuts off if not used for 15 minutes.
- To optimize battery life, do NOT leave the tester on charge for more than 24 hours at a time.

### **To Charge the Battery**

Use **ONLY** the charger provided with your tester. There are other chargers that may look the same, but they will damage the tester.

1. Shut the tester power "OFF."
2. Plug the charger into the tester socket.
3. Plug the charger power cord into a standard wall outlet.

(**NOTE:** While the tester is charging, the power "ON"/"OFF" keys do not work.)



# Battery Testing

## To Begin Testing

Press [POWER ON] to turn the tester "ON." If load leads are already connected to a battery, the display reads "REMOVE THE RED HEAVY LOAD LEAD" and a tone sounds (see Figure 4). Remove the red (positive) load lead from the battery; then reconnect it.

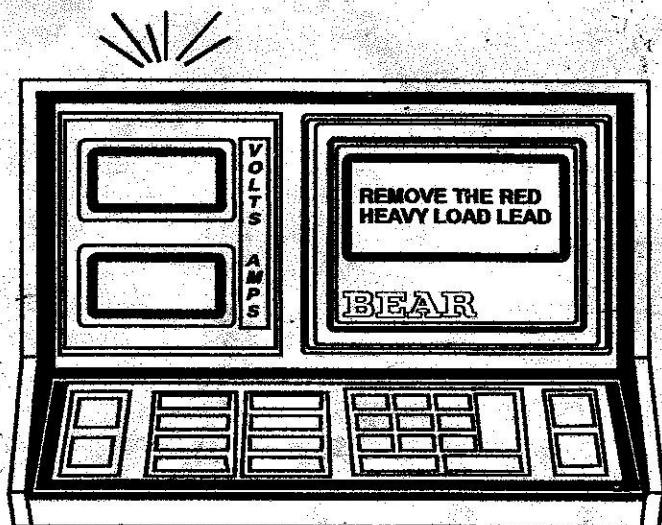


Figure 4

There is a temperature sensor in the red load lead. When you reconnect this lead at the beginning of testing, the computer re-sets the temperature sensor and some other internal settings.

When the tester is first turned "ON," the main display shows "search volts" (a voltmeter), engine RPM, and number of cylinders (see Figure 5). This is the multi-meter function. Complete instructions for the multi-meter are in the "Multi-Meter" section of this manual.

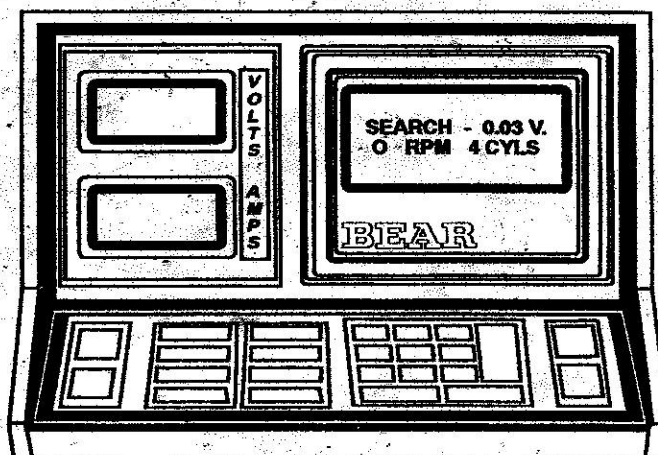


Figure 5

## To Abort Testing

Press one of the test selection keys. The tester will move to the beginning of the test selected.

# Automatic Tests

## Battery Test

The battery test uses a number of variables, including temperature, recovery voltage and other electrical factors to diagnose a battery. It tells you whether the battery is "GOOD," "BAD," or requires charge and re-test.

### Hookup

Make sure the vehicle battery cables and terminals are clean. Wire brush them if necessary.

1. Clamp the black load lead to the vehicle negative battery terminal.
2. Clamp the red load lead to the vehicle positive battery terminal.
3. Make sure load leads are connected securely.

### Test Procedure

- A. Press [BATTERY TEST].

The red load lead has a temperature sensor to read battery temperature. In the rare event that the temperature sensor is not working, the display will first read "INPUT BATTERY TEMP." Estimate the battery temperature; then press either the "7", "8," or "9" key on the numeric keypad to indicate the temperature that the battery is closest to:

- [7] for 0°F (-18°C).
- [8] for 32°F (0°C).
- [9] for 70°F (21°C).

The positive load lead may need replacing. See "Field Replacement Procedures" in the "Maintenance" section of this manual.

- B. Display reads "INPUT CCA: 0) CHANGE UNITS."

Press [0] to change battery rating units. The unit reading on the display will change to "DIN." Press [0] again to page through "IEC," "A-HR." The unit setting will be retained after tester power is turned "OFF."

Enter the battery rating, using the numeric keypad (see Figure 6). Then press [ENTER] to begin the Battery Load Test. The battery rating is usually printed on the battery.

For SEARS testers, display says "INPUT ST#" instead of "INPUT CCA." Input the Sears battery stock number and press [ENTER]. The display will show CCA. From there press [CONTINUE]. If the number seems wrong, press [CLEAR] to return to first input screen, then enter correct number.

If Sears battery stock number is unknown, press [0] to input CCA. (**NOTE:** The tester will not accept any rating lower than 100 or higher than 1500 CCA.)

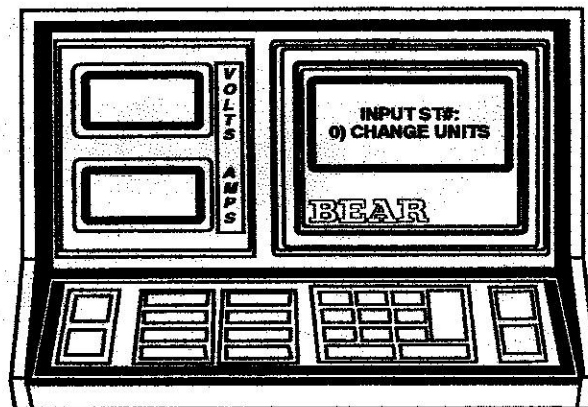


Figure 6

- C. Display reads "TEST IN PROGRESS" (see Figure 7).

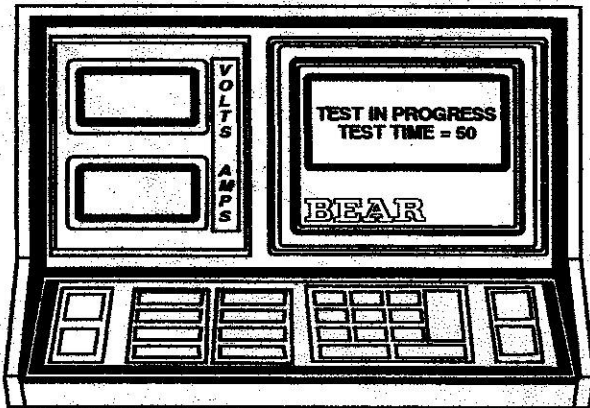


Figure 7

(Tester may wait a few seconds for temperature reading.) When test begins, a 50-second countdown is displayed. During this 50 seconds, tester applies a load to the battery, releases it to let the battery recover, then applies it again. (When the load is applied, listen for the sound of the solenoid closing.)

**NOTE:** TO ABORT during test, press any function key, or press [POWER OFF].

## Test Results

The Main Display reads "TEST RESULT" and shows diagnosis (see Figure 8):

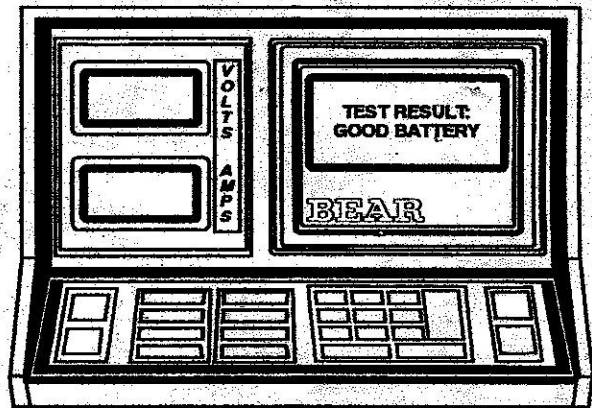


Figure 8

**"GOOD BATTERY"** - The battery is capable of holding a charge and performing to specs.

**"GOOD, LOW CHARGE"** - The battery is good, but it should be recharged.

**"BAD BATTERY"** - The battery will not hold a charge and perform to specs. It should be replaced.

**"CHARGE & RETEST"** - The battery condition cannot be determined until after it is fully charged.

**IMPORTANT NOTE:** The battery MUST first be completely charged per the battery manufacturer's recommendations before running the "Battery Test After Charge."



## Starting Test

Prepare the vehicle so the engine can be cranked without starting. While the engine is cranked, the tester will read the condition of the starter and starting circuit. The tests results show cranking volts and cranking amps, and whether starter is "good" or "bad."

### Prevent the Engine from Starting:

Prepare the vehicle so it will not start when the engine is cranked. Use one of the methods listed below, depending on the type of vehicle being tested, or refer to manufacturer's information.

1. Disconnect battery power to the positive coil terminal. This prevents the coil from activating secondary ignition.
2. On vehicles with a conventional distributor cap, remove the coil lead from the top of the distributor cap and ground it.

**CAUTION:** Failure to properly ground the wire may result in damage to the system.

3. On some computer-controlled vehicles equipped with fuel-injection, hold the throttle wide open while cranking the engine. The fuel injection system automatically disables itself because it assumes that the engine is flooded. If engine starts at first, shut it "OFF" and crank again, keeping the throttle wide open.
4. On vehicles with Throttle Body Injection (TBI) or Central Fuel Injection (CFI), disconnect the fuel injector. This will disable fuel flow.

**OR**

5. Remove the power to the fuel pump to disable fuel flow on any vehicle with Electronic Fuel Injection (EFI).

## Hookup

Make sure vehicle battery cables and terminals are clean. Wire brush if necessary.

1. Clamp the black load lead to the vehicle negative battery terminal.
2. Clamp the red load lead to the vehicle positive battery terminal. Make sure both load leads are connected securely.
3. Remove grey amps probe from any conductor and press "Zero Amps" key. (See "Zero Amps" section for complete details.)

Then clamp the grey amps probe around vehicle negative battery cable, so that the arrow on the probe points towards the battery. Be sure the probe is around all wires running to the vehicle negative battery terminal connector.

## Test Procedure

- A. Press [STARTING TEST]. The display reads "INPUT # CYLS" (see Figure 9). Type in the vehicle's number of cylinders on the numeric keypad and press [ENTER]. (The computer accepts numbers from 2 to 12.)

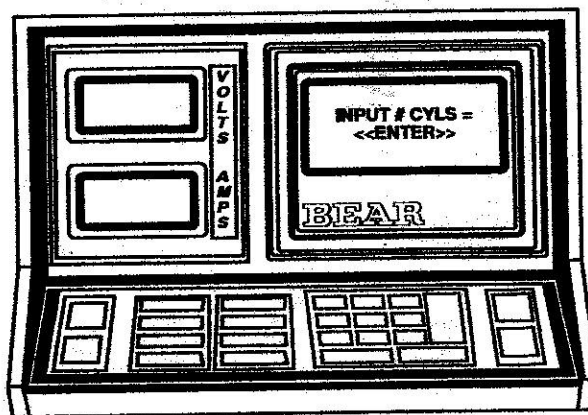


Figure 9

- B. Display reads "DISABLE IGNITION AND CRANK ENGINE" (see Figure 10). Disable the ignition so the engine will not start when cranked (see previous page.) When vehicle is disabled, crank the engine.

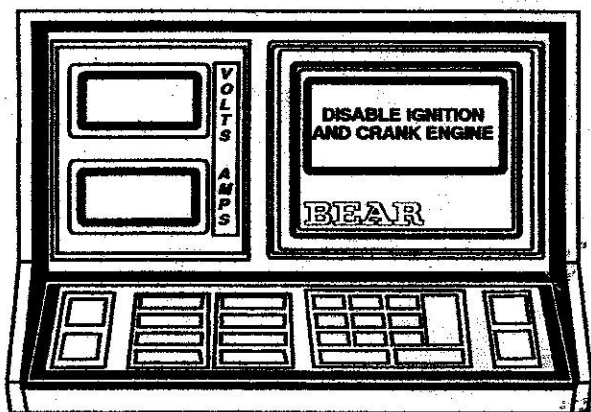


Figure 10

- C. Display reads "MAINTAIN CRANKING" (see Figure 11). Keep cranking the engine for a few seconds, until display reads "TEST COMPLETE."

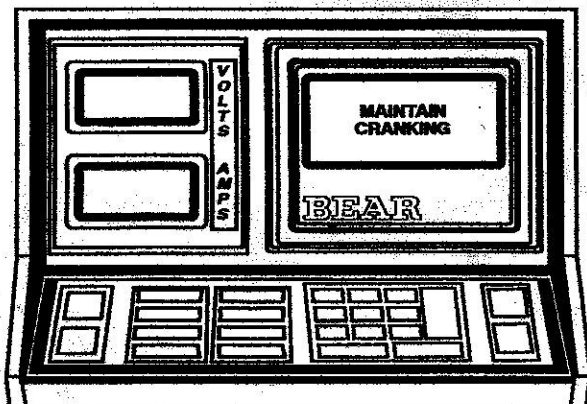


Figure 11

- D. When test is complete, display reads "TEST COMPLETE" or "TEST INCOMPLETE" (see Figure 12). Stop cranking the engine. To see test results, press [CONTINUE].

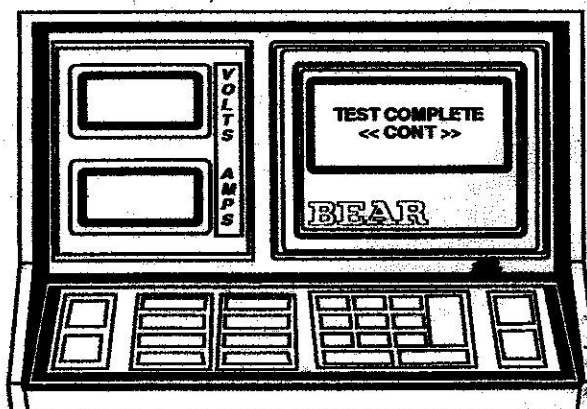


Figure 12

## Results

Press [CONTINUE]. The display shows cranking volts.

Press [CONTINUE] again to see cranking amps.

Press [CONTINUE] again to see starter diagnosis: either "GOOD STARTER" or "BAD STARTER" (see Figure 13).

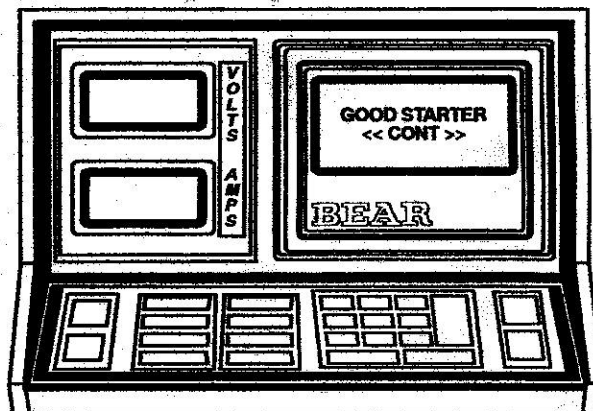


Figure 13

The results are displayed in a loop, so press [CONTINUE] again to return to cranking volts. Press [CONTINUE] again to see cranking amps; and so on.

To get out of the loop, select another test.

**IS IT A DIESEL?** - If current draw was unusually high, display asks "Is it a diesel?" Press [1] if YES; [2] if NO.

**DIESEL STARTERS** - Some large diesel engines with good starters may draw cranking current in excess of the tester's diagnostic limits. Always check the manufacturer's specifications before condemning diesel starters.

**"TEST INCOMPLETE"** - The display will show "TEST INCOMPLETE" instead of results if the vehicle's battery was too low to continue cranking, or if, for any other reason, cranking was discontinued during the test.

Correct the problem and run test again.

## Charging System Test

In the charging system test the tester takes readings both at high RPM and at idle. Results show regulator volts and peak amps, and whether diodes are good or bad.

### Hookup

Make sure the vehicle's battery cables and terminals are clean. Wire brush them if necessary.

1. Clamp the black load lead to the vehicle's negative battery terminal.
2. Clamp the red load lead to the vehicle's positive battery terminal. Make sure both load leads are connected securely.
3. Remove grey amps probe from any conductor and press "Zero Amps" key. (See "Zero Amps" section for complete details.)
4. Then clamp the grey amps probe around vehicle negative battery cable, so that the arrow on the probe points towards the battery. Be sure the probe is around all wires running to the vehicle negative battery terminal connector.

### Test Procedure

- A. Start the engine.
- B. Press [CHARGING SYSTEM TEST]. THE DISPLAY MUST SHOW THE CORRECT # OF CYLINDERS in order for RPM reading to be correct. The bottom line of the display shows number of cylinders, which is automatically set to 4 unless you have changed it during a previous test.

To change the number of cylinders, press that number on the numeric keypad. Press any number from 2 - 12.

- C. Top line of display reads "RUN ENGINE AT 2000 RPM" (see Figure 14). Set engine speed to at least 2000 RPM. When computer detects RPM around 2000, display flashes "MAINTAIN 2000 RPM."

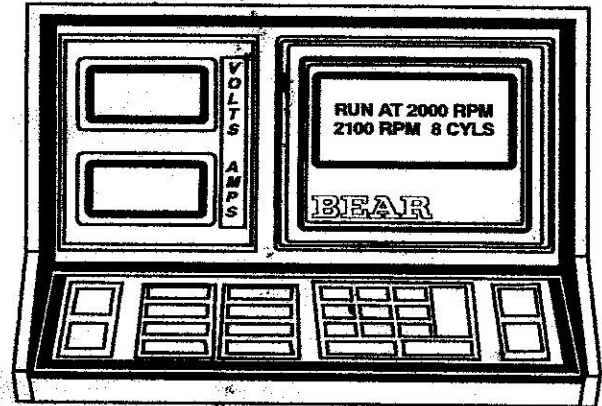


Figure 14

(If RPM reading says "N/A," see "RPM Not Available," next page.)

Hold RPM at 2000. After an adjustment period, a counter appears in the corner of the display and counts down from 10 seconds (see Figure 15).

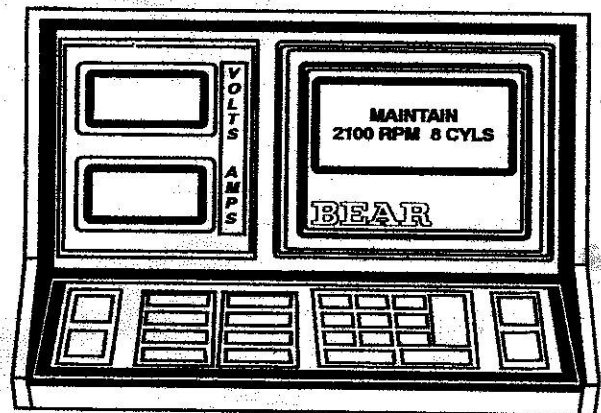


Figure 15



- D. After 10 seconds, the display reads "RUN AT IDLE" (see Figure 16). Reduce engine speed to idle. When the computer detects idle speed, display reads "MAINTAIN IDLE."

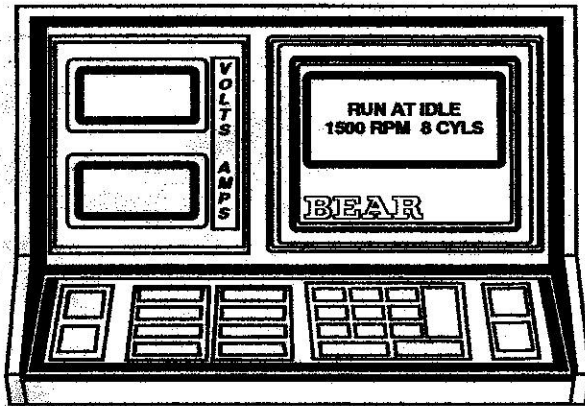


Figure 16

Maintain the engine at idle speed. (For engines larger than 4 cylinder, idle means less than 1000 RPM (see Figure 17). For 4 cylinder or smaller engines, idle is 1200 RPM or less.) The tester checks the diode condition.

(If engine speed is not low enough, set it as low as possible and press [CONTINUE].)

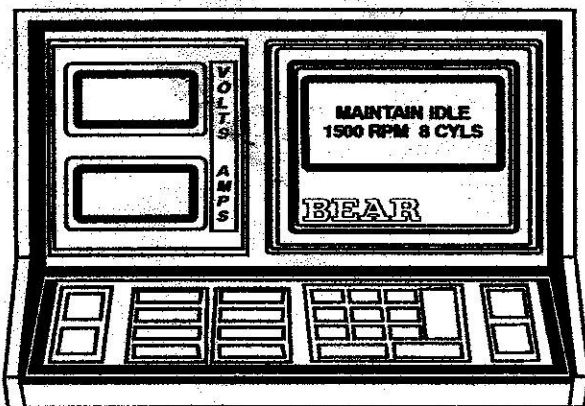


Figure 17

- E. After idle test, the display may read "RUN 800-1000 RPM" (see Figure 18). This message appears if RPM was not high enough, or if conditions were not right during the diode reading. For the computer to properly read diode condition, RPM must be between 800 and 1000. Raise RPM to between 800 and 1000 and hold it. (If RPM is "N/A," press [CONTINUE].)

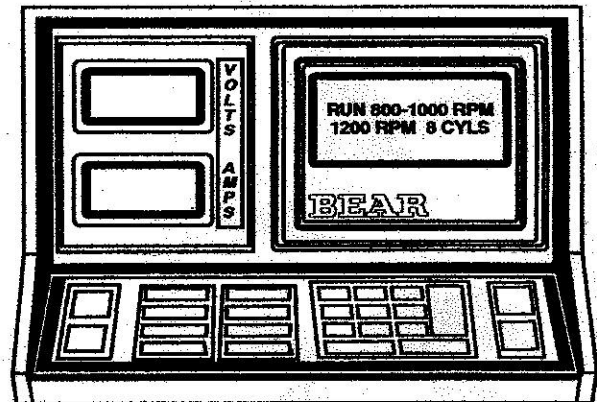


Figure 18

Display then reads "MAINTAIN IDLE." Hold idle between 800 and 1000 while the diode pattern is read again. This process may last a few seconds. When test is complete, display reads "TEST COMPLETE."

- F. The test is now complete. Display reads "TEST COMPLETE" (or "TEST INCOMPLETE"). Shut the engine "OFF."

Press [CONTINUE] to see results.

*Continued...*

## Automatic Tests

### Charging System Test (continued)

#### RPM Not Available

If the battery tach cannot read RPM during the charging test, the RPM value reads "N/A"—Not Available. In this case, when charging test reads "RUN ENGINE AT 2000 RPM," the lower right of the display flashes "\*" <CONT>>" (see Figure 19). It is still possible to run the test as follows:

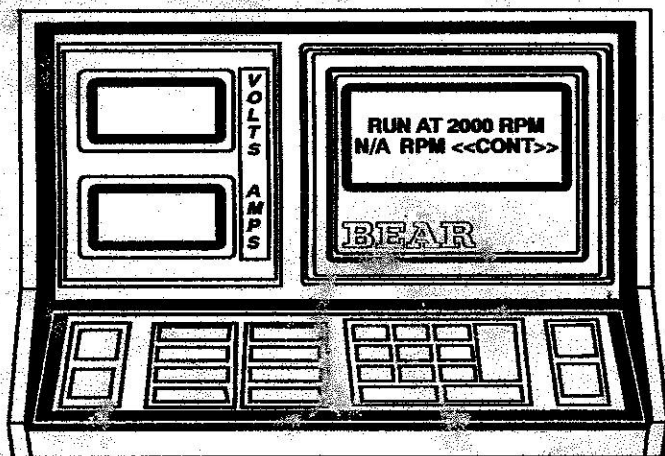


Figure 19

1. Run the engine as close to 2000 RPM as possible. Use the vehicle dashboard tachometer, or estimate engine speed. When engine speed is approximately 2000 RPM, press [CONTINUE].

Display says "MAINTAIN 2000 RPM."

2. Hold the engine speed at approximately 2000 RPM until the display reads "RUN AT IDLE" (see Figure 20). Then set engine at idle and press [CONTINUE]. The remainder of the charging test runs normally.

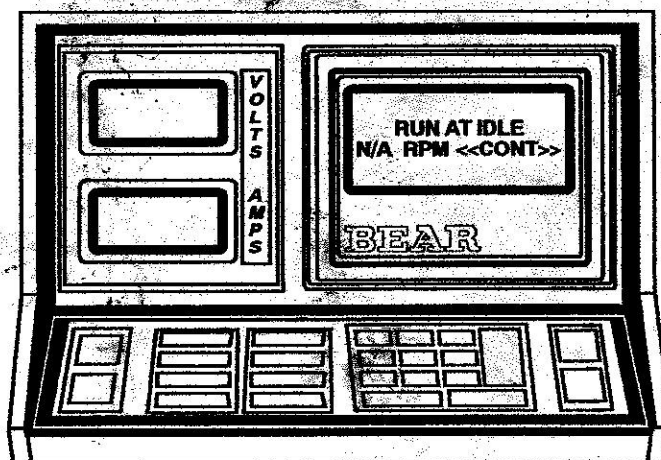


Figure 20

#### Results

The first result displayed is regulator volts. This is the maximum voltage read during charging system test.

1. If amps stayed higher than 20 during the charging test, a star (\*) appears near regulator volts on the display. Regulator volts are probably lower than normal because charging current was so high.
2. Press [CONTINUE] to see peak amps. This is the maximum alternator output detected during the test.
3. Press [CONTINUE] again to see diode condition; the display says the diode pattern is either "GOOD" or "BAD."



## Battery Test After Charge

The display message may read "N/A" — Not Available. When this occurs:

1. If RPM was high during the idle part of the test [CONTINUE] was pressed, run the charging test again. Make sure idle is adjusted correctly before running the test.
2. In any other case, the N/A result requires further pinpoint testing. Use the multi-meter to perform such tests as a full-field test, fusible link test, etc. The exact procedures depend on the vehicle being tested. Refer to shop manuals or to manufacturer's information.

Results are displayed in a loop. Press [CONTINUE] to see regulator volts. Press [CONTINUE] again for peak amps, and so on.

Run this test ONLY after both of the following conditions have been met:

- The message "CHARGE AND RETEST" appeared after the regular battery test, and run on the same battery currently being tested;
- The battery has been completely charged following the battery manufacturer's charging recommendations.

## Hookup and Test Procedure

The initial test procedure is the same as for the other Battery Test:

1. Connect test leads.
2. Enter CCA value.
3. Perform test.

## Results

This test takes into account that the battery has just been charged. It will not diagnose any battery as "CHARGE AND RETEST." It calls the battery "GOOD" or "BAD."

## Other Functions

### Multi-Meter and Load On/Off Key

Whenever the tester is turned "ON," the default setting is "Multi-Meter." The multi-meter function can also be accessed by pressing [MULTI-METER] from any other test.

The multi-meter function displays all meter readings at the same time. The main display shows RPM and "search volts" (voltmeter reading). Current (amps) and load lead volts are also shown on their respective displays.

Use the multi-meter function along with the "LOAD ON/OFF" key for manual testing.

### Multi-Meter

Top line of the main display reads "SEARCH - X.XX V" (see Figure 21). This is the "search volts" reading, the voltage being read through the search volts leads (+/- 40.00V DC).

When using search volts leads, make sure to use both leads. If only one lead is used, the search volts reading will be inaccurate.

The bottom line of the display shows RPM and number of cylinders, which is automatically set to 4 unless you have changed it during a previous test. (Or, if 0 is selected for the number of cylinders, RPM will be "N/A" - Not Available.)

THE DISPLAY MUST SHOW THE CORRECT # OF CYLINDERS in order for RPM reading to be correct.

To change the number of cylinders, press that number on the numeric keypad. The tester will accept any number from 2 - 12.

If RPM is not displayed at all, make sure battery load leads are securely connected and the correct number of cylinders is displayed.

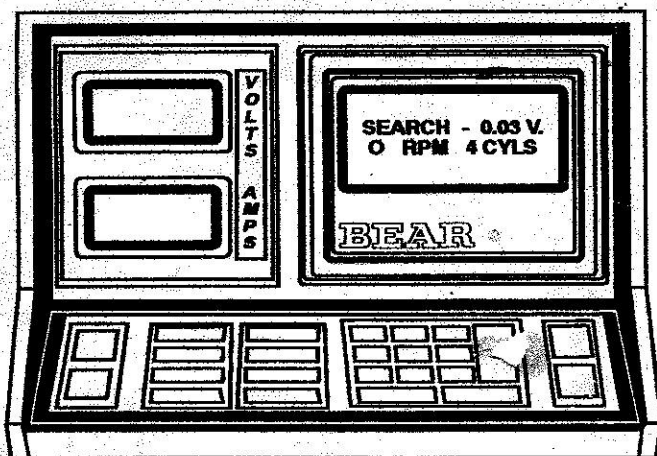


Figure 21

## Load On/Off Key

Use the "LOAD ON/OFF" key to put a load on the battery for testing purposes, as follows:

- A. Press [LOAD ON/OFF] once to put the load on. The bottom line of the display reads "LOAD ON" (see Figure 22).

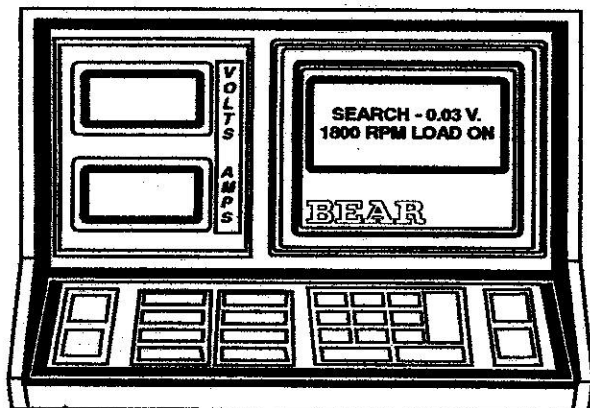


Figure 22

- B. The load will remain "ON" for 15 seconds unless you press [LOAD ON/OFF] to release it. After 15 seconds, the load is automatically released.
- C. After the load is released, there is an automatic cooldown period lasting as long as the load period. The display reads "WAIT" and counts down to zero (see Figure 23). At zero, the multi-meter display returns.

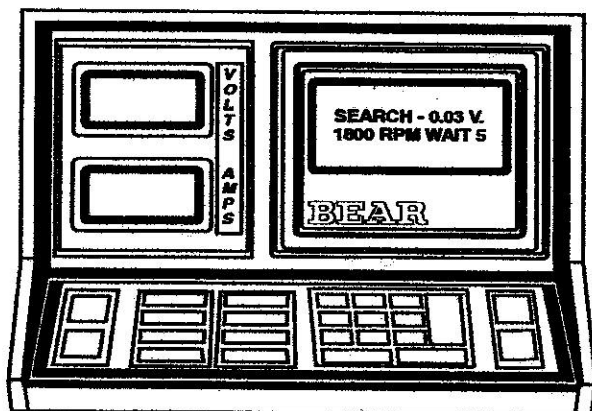


Figure 23

## Review Results

Press the [REVIEW RESULTS] to display the latest results from all tests that were performed. Results are displayed in a "CONTINUE loop"; keep pressing [CONTINUE] to page through them, as shown below.

Results from the most recent tests will be stored even after power is shut "OFF." To retrieve results after power is shut "OFF," turn power back "ON" and press [REVIEW RESULTS].

When a test is selected after turning power back "ON," all old results are cleared from memory to prepare for the new testing session.

If a certain value has not been obtained since power was last turned "ON" and a test selected, that value will be skipped in the loop. This is the loop:

1. Press [REVIEW RESULTS] to see Battery diagnosis.
2. Press [CONTINUE] to see Cranking Volts.
3. Press [CONTINUE] to see Cranking Amps.
4. Press [CONTINUE] to see Starter diagnosis.
5. Press [CONTINUE] to see Regulator Volts.
6. Press [CONTINUE] to see Peak Amps.
7. Press [CONTINUE] to see Diode Pattern results.

To get out of the loop, select another test or the multi-meter function, or turn power "OFF."



### Zero Amps

"Zero Amps" sets the grey amps probe reading to zero. For optimum performance, run this procedure before every Starting and Charging test, and before using the Amp reading on the Multi-meter.

"When the amps probe is "zeroed," the computer sets the probe reading to zero. This is slightly different from the complete calibration procedure. During the calibration procedure, the computer sets the reading at zero at an amperage reading that is determined by the computer. The calibration procedure is more thorough, but takes longer to complete.

The "Zero Amps" procedure is very fast and may be performed frequently to serve as a quick assurance of accuracy. Calibration, on the other hand, does not have to be performed very often. (See "Calibration" section of this manual for more information.)

#### Procedure

- A. Remove the grey amps probe from around any wire and hold it away from any conductors present. Allow it to close completely. Do not place fingers or anything else through the hole.
- B. Press [ZERO AMPS]. (If the display reads "REMOVE GREY AMP PROBE," make sure the probe is not around a conductor. Then press [CONTINUE].)

The display reads "PROBE CALIBRATED." The probe is "zeroed."

The tester automatically switches to the multi-meter function in approximately 3 seconds (unless another test or function is selected).

### Calibration

If the tester senses it is out of calibration, the message "CALIBRATION IS NEEDED" will appear.

The procedure will calibrate all the tester's leads - the load leads, grey amps probe, and "search volts" leads.

A good, fully-charged 12-volt automobile battery is needed to complete the procedure.

#### Procedure

To calibrate the tester, follow the steps below. If any message appear on the display that do not appear in these instructions, follow the directions on the display. For further explanation of any displayed messages, refer to the "MESSAGES" section of this manual.

- A. Press [CALIBRATION]. Display read: "INPUT TEMP UNITS." Press:  
[1] for Fahrenheit,  
[2] for Celsius.

This sets the units for manual temperature input during battery test. (**NOTE:** Manual temperature input not always necessary.) Temperature settings will be retained after the tester is shut "OFF."

- B. Display reads "SHORT SRCH VOLT LEADS" (see Figure 24). To "short" the search volts leads, clip them together so that the metal clips are in complete contact with each other. Then press [CONTINUE].

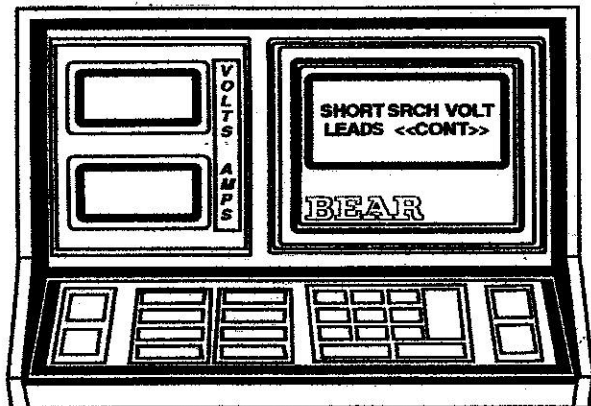


Figure 24

- C. Display reads "SEE CALIBRATION DIAGRAM" (see Figure 25). The calibration diagram is on the tester housing. The same diagram is shown on this page. Connect all the test leads as shown in the diagram (use a good, fully-charged 12-volt automobile battery):

1. Connect the positive (+) load lead to the positive battery terminal.
2. Connect the negative (-) load lead to the negative terminal of the battery.
3. Connect the search volt leads to the vehicle battery posts. Connect the positive to positive, negative to negative. If a connection cannot be made to the battery posts, clip them to the brass part of the load clamp jaws.

4. Connect the grey amp probe around the negative load lead cable. When the leads are connected as shown in Figure 26, press [CONTINUE].

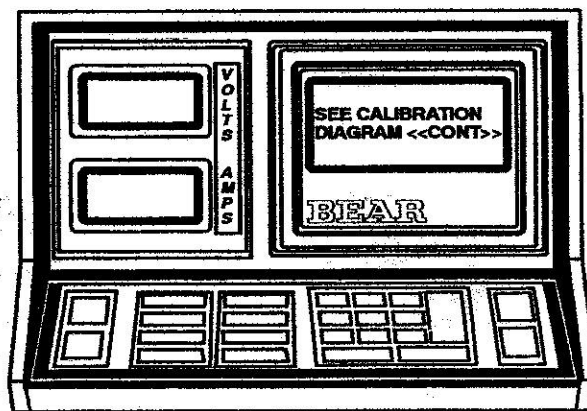


Figure 25

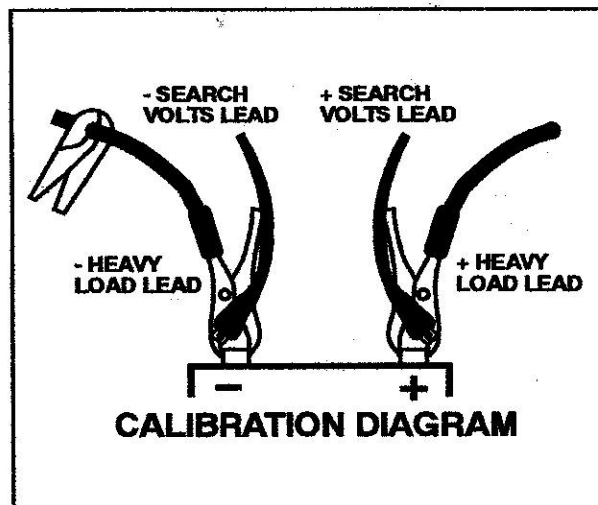


Figure 26

- D. Under normal conditions, display now reads "CALIBRATION IN PROGRESS."

During calibration, the tester puts a load on the battery. Calibration takes only a few seconds.

- E. When calibration is complete, display reads "UNIT CALIBRATED." If no other selection is made, the display automatically switches to the multi-meter function after 15 seconds.

# Messages

The following are main display messages that may appear on occasion. These messages are not covered in the standard operating procedure.

## Testing Messages

**AMP PROBE FAULTY** - Grey amps probe is faulty. See Diagnostic Procedure in the "Maintenance" section of this manual.

**BATTERY VOLTAGE TOO LOW** - The automobile battery voltage is too low for testing.

**CALIBRATION IS NEEDED** - The test leads must be calibrated. Run calibration procedure.

**CHECK HEAVY LOAD CLAMPS** - The heavy load lead connection is erratic when load is placed on the battery. Check connections.

**CONNECT BATTERY CLAMPS** - The battery clamps are reading no voltage.

**SWITCH BATTERY CLAMPS** - The battery clamps are attached to the wrong polarity battery posts. Switch them.

## Calibration Messages

**BATTERY VOLTAGE TOO LOW** - The automobile battery voltage is too low to calibrate. Connect the leads to a good, fully charged battery and repeat the procedure.

**CHARGE BATTERY & REPEAT** - The car battery does not have enough charge to be used for the calibration procedure. Connect leads to another, fully charged battery and press [CONTINUE]. (If another battery is unavailable, remove the leads and completely charge the original battery. Then repeat the procedure.)

**CHECK HEAVY LOAD LEADS** - Readings are unstable when load is placed on the battery. Check Heavy Load Lead connections.

**CHECK SEARCH VOLT LEADS** - Make sure search volts leads are properly connected. Press [CONTINUE]. (Leads may be correct but the battery is too low.)

**CONNECT BATTERY CLAMPS** - The battery clamps are reading no voltage.

**CONNECT GREY AMP PROBE** - Connect the grey amps probe around the negative load lead cable.

**CONNECT SEARCH VOLTS** - The tester is not reading sufficient voltage through search volts leads when it tries to calibrate. Make sure the search volts leads are properly connected, then press [CONTINUE].

**SEARCH VOLTS NOT SENSED** - The search volts are not sensed by the computer. See Diagnostic Procedure in the "Maintenance" section of this manual.

**SEARCH VOLTS OUT OF CAL** - The search volts are beyond specs required for automatic calibration. See Diagnostic Procedure in the "Maintenance" section of this manual.

**SWITCH SRCH VOLT LEADS** - The search volts leads are attached to the battery post of the wrong polarity. Switch them.

# Maintenance

## Daily Maintenance

- Clean outside surface of tester, keypad and display. Wipe clean with a mild, multi-purpose cleaner.

- Clean and inspect the test leads, as follows:

1. Clean the cables with a mild, multi-purpose cleaner. While cleaning the cables, inspect for damage and replace as necessary.

**CAUTION:** DO NOT use solvents or harsh cleaners on the cables; otherwise, they will eventually dry out and crack.

2. Keep the clamp ends clean. Use a small wire brush if necessary. Or, if the clamp ends are corroded, use emery cloth to clean the brass.

**CAUTION:** DO NOT use carburetor cleaner or harsh chemical solvents on the clamps. Carburetor cleaner may damage sensors.

3. Clean the clamp casings with a mild detergent or cleaner.

# Diagnostic Procedure

## Introduction

Test leads, charger and the tester's internal battery are user replaceable.

The diagnostic procedure listed below helps determine whether any of these user-serviceable parts is the cause of a problem.

This section makes frequent reference to the "Checks" procedures in the next section.

When a user-serviceable part needs to be replaced, see "Field Replacement Procedures."

If the tester itself needs service, follow the instructions in the "Warranty Statement" in this manual.

## The First Thing to Do ...

When a unit fails, first try shutting the power "OFF" and turning it back "ON." Any time the tester fails, the failure may be temporary, due to a number of possible temporary conditions. Shut the power "OFF" and "ON" a number of times, making sure to press [POWER ON] firmly for at least 1 second every time the unit is turned "ON."

- **IF** the unit recovers, there is no problem.
- **IF** the problem still exists, run through the diagnostic procedure, starting next page.
- **IF** one "if" statement does not apply, go to the next "if" statement at the same level.

### 1. **IF unit does not "power up" correctly...**

- IF, when tester is turned on, the top line of the LCD contains 16 boxes and the bottom line is clear, the unit has failed and cannot be repaired (see "Shipping Instructions" in "Warranty" section).

- IF nothing appears on the display when unit is turned on, make sure proper procedure is being followed. Press [POWER ON] firmly and hold it for at least 1 second.

- IF nothing appears on the LCD display when correctly turned on, try pressing some of the keys. If a faint "beep" is heard when pressing a key, the battery in the unit could be discharged. Try charging the unit overnight with the included charger.

- IF charging the unit does not help, the charger may be faulty. Check the charger with a voltmeter, following the procedure in the "Checks" section.



**WARNING!** USE ONLY THE CHARGER INCLUDED WITH THE TESTER (part number 697-95452 or 697-97228). Use of any other charger will void the warranty and may damage the unit and/or cause a fire.

- IF charger is good, but the unit still did not hold a charge, the unit may have a bad internal battery. Check the battery according to the procedure in "Checks" section.



## 2. If unit **DOES** "power up" correctly...

- IF, when the unit is powered up, it does not beep or respond at all when any key is pressed, the unit needs service (see "Shipping Instructions").

- IF when the unit is turned on, it continually beeps and the clamps are not connected to anything, the unit needs service (see "Shipping Instructions").

- IF volts display (battery voltage) reads "0.00 volts" (or reads a highly unlikely voltage) when the leads are **securely** connected to a good battery with a 12-volt charge, the unit may need service. Try connecting the leads to several different batteries, each time making sure that leads are **securely** connected to the correct battery terminals.

- IF voltage reading is still incorrect, check the test leads with an ohmmeter, according to the procedure in the "Checks" section.

- IF the test leads are OK, the unit needs service.

**NOTE:** Connect both the search volts and the load leads to the battery and compare the readings. Both should read approximately the same.

- IF search volts reads "0.00 volts" when connected to a 12-volt battery and the load leads read correctly, check the search volts leads with an ohmmeter (see "Checks" section).

- IF the unit consistently displays "CHECK CLAMPS" message during battery test even after pressing [CONTINUE], the unit may need service. Try testing several different batteries, each time making sure that leads are **securely** connected to the correct battery terminals.

- IF the problem still occurs, check the test leads with an ohmmeter (see "Checks" section).

- IF test leads are OK, the unit needs service (see "Shipping Instructions").


# Checks

These checks are used in conjunction with the preceding "Diagnostic Procedure" section. If there is a problem with the unit its cause is uncertain, first run through the "Diagnostic Procedure" section for the appropriate checks.

## Charger Check

First make sure the charger is plugged into a "live" outlet. If not, use an outlet that works and try charging the battery again. To check the charger with a voltmeter:

1. Plug the charger into a working outlet.
2. Read the voltage at the jack. Put the positive (+) voltmeter lead to the outside portion of the jack. Put the negative (-) voltmeter to the inside. **MAKE SURE THE POLARITY IS CORRECT.**
3. There should be between 4.5 and 10 volts DC. If the reading is less than 4.5 volts, the charger is not functioning correctly and the user should call for service (see "Field Replacement Procedures" in the "Warranty" section of this manual).

 **WARNING!** USE ONLY THE CHARGER RECOMMENDED FOR THIS TESTER (part number 697-95452 or 697-97228). Use of any other charger will void the warranty and may damage the unit and/or cause a fire.

## Internal Battery Check

To access the battery, remove the seven black phillips head screws on the bottom of the unit and remove the red housing. Disconnect the wires from the battery and, observing proper polarity, check the tester's internal battery with a voltmeter, as follows:

1. First make sure the charger is good (see "Charger Check").
2. Using a good charger, put the tester's internal battery on an overnight charge.
3. Connect the voltmeter's positive lead to the positive (+) terminal of the battery. Put negative voltmeter lead to the negative (-) terminal of the battery. Battery should be around 6 volts when charged. If, after being fully charged by a good charger, battery is below 6 volts, replace the battery (see "Field Replacement Procedures").

## Test Lead Checks

**Grey Amps Probe** - If the probe is bad, an "AMP PROBE FAULTY" message will appear. Replace it (see "Field Replacement Procedures").

**Search Volts Leads** - Disconnect search volts leads from the tester and check them with an ohmmeter. Put one ohmmeter lead to the positive (red) search volts clip; put the other end to the positive pin. Try both pins to determine which is positive. Ohms should be less than 0.2. If not, replace "search volts" leads (see "Field Replacement Procedure"). Repeat the same procedure for the negative lead.

Finally, connect ohmmeter leads to both pins. There should be no continuity between the pins. If there is, replace the lead (see "Field Replacement Procedures").

## Battery Load Leads

**NOTE:** When the temperature diode fails, the computer will detect the failure at the beginning of the battery test. The message "INPUT BAT. TEMP." will appear and the second line of the display will indicate three temperature range selections. When this message appears at the start of the Battery Test, the positive (+) battery load lead must be replaced (see "Field Replacement Procedures").

To run the test after this failure message has appeared, select 7, 8 or 9, depending on the battery's estimated temperature.

## Checking the Load Leads with an Ohmmeter

The ends of the load leads run under a plastic cover on the bottom of the tester. To access the load lead cable ends, remove the screws holding the cover in place. Check the leads as follows:

### Positive (+) Lead:

The positive (+) lead has three separate circuits: battery load, volts and temperature diode.

If the temperature diode is bad, the computer will detect it (see "Temperature Diode Failure," above). To check the other two circuits of the lead, use an ohmmeter as follows:

1. **Battery Load Circuit** - Put one ohmmeter lead to the exposed end of the cable, where it is bolted to the bottom of the unit. Put the other ohmmeter lead to the clamp's lower jaw (the jaw with the red boot on the handle). Ohms should read "0.0." If the meter reads more than 0.2 ohms, make sure the clamp is clean, and re-check. If resistance is still high, the lead should be replaced. See "Field Replacement Procedures."

2. **Volts Circuit** - Where the cable is attached to the bottom of the unit are white, black and red wires from the cable that plug into connector sockets. Remove the black wire from its connector socket and connect one of the ohmmeter leads to it.

Connect the other ohmmeter lead to the upper jaw on the battery clamp. Ohms should read "0.0." If the meter reads more than 0.1 ohms, the entire positive lead should be replaced. (See "Field Replacement Procedures.")

## Negative (-) Lead

The negative lead has two circuits: battery load and volts.

1. **Battery Load Circuit** - Put one ohmmeter lead to the exposed end of the cable, where it is bolted to the bottom of the unit. Put the other ohmmeter lead to the clamp's lower jaw (the jaw with the black boot on the handle). Ohms should read "0.0." If the meter reads more than 0.2 ohms, the lead should be replaced. (See "Field Replacement Procedures.")
2. **Volts Circuit** - Attached to the bottom of the unit is a cable. A small wire coming out of the end of the negative cable plugs into a socket on the bottom of the unit. Remove this wire from its connector socket and connect one of the ohmmeter leads to it.

Connect the other ohmmeter lead to the upper jaw on the battery clamp. Ohms should read "0.0." When there is more than 0.1 ohms, the whole positive lead should be replaced. (See "Field Replacement Procedures.")

## Field Replacement Procedures

The following parts are covered by warranty for only 30 DAYS: 6V battery, battery charger and all test leads.

### To Replace a Battery

1. Remove the seven black phillips head screws on the bottom of the unit and remove the red housing.
2. Using a 11/32" 12-point deepwell socket, remove the battery holder and battery.
3. When replacing the battery, make sure the battery is wired as shown in Figure 27.
4. Reinstall the battery holder and cover.

### To Replace the Battery Load Leads

1. The ends of the load leads run under a plastic cover on the bottom of the tester. Remove screws holding the cover in place.
2. Remove the strain-relief screw for the cable being replaced.
3. Unplug the small 18Ga. wire(s) for the cable being replaced.
4. Remove the bolt from the copper strip underneath the unit and remove the cable.
5. Attach the bolt and the new cable to the copper strip.
6. Tighten the bolt to 15 ft/lbs torque.  
(NOTE: The bolt must be torqued to specification.)
7. Install the 18Ga. wires from the new cable according to the color code on the decal.
8. Reinstall the strain relief screw and the plastic cover.

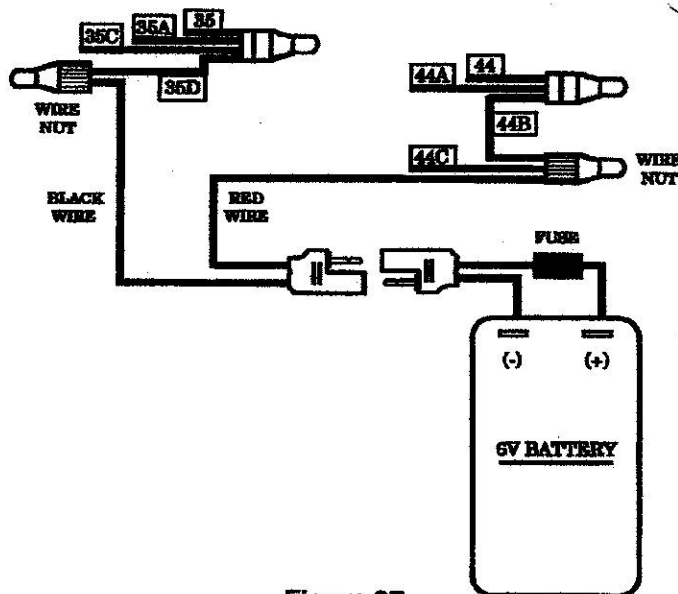


Figure 27

### To Replace a Charging Unit

When replacing the charging unit, unplug it from the wall before unplugging it from the unit.

### To Replace Search Volt Leads

1. Remove the seven black phillips head screws on the bottom of the unit and remove the red housing.
2. Unscrew lock rings on circular plastic connectors. Remove leads and install replacement leads.
3. Replace cover and screws removed in Step 1.

### To Replace Amp Probe

1. Remove the seven black phillips head screws on the bottom of the unit and remove the red housing.
2. Unscrew lock rings on circular plastic connectors. Remove leads and install replacement leads.
3. Replace cover and screws removed in Step 1.