NAPA®

PowerSensor® PSM2 *TURBO*

Battery / Starting / Charging System Analyzer

For testing all NAPA batteries by part number, including automotive, commerical, marine, deep cycle, and gel deep cycle, 6 volt, 8 volt, and 12 volt batteries. Also for testing 6 and 12 volt automotive and commericial batteries using their labeled rating, as well as for testing 12 and 24 volt charging systems.

MIDTRONICS

INSTRUCTION MANUAL

ESTIMATED FAST CHARGING TIMES
FOR CHARGE & RETEST RESULT

Always follow the manufacturer's instructions for the particular charger you use. The times and charging rates listed below are estimates based on a battery at 25% state of charge. Required charging time may vary depending on actual state of charge of the battery.

6 and 12 VOLT AUTOMOTIVE BATTERIES

RESERVE CAPACITY RATING RANGE	ESTIMATED FAST-CHARGING TIME
<80 MIN.	2.5 Hours @ 20 amp rate 1.5 hours @ 30 amp rate
80-125 MIN.	3.75 hours @ 20 amp rate 1.5 hours @ 50 amp rate
125 - 170 MIN.	5 hours @ 20 amp rate 2 hours @ 50 amp rate
170 - 250 MIN.	7.5 hours @ 20 amp rate 3 hours @ 50 amp rate
>250 MIN.	6 hours @ 40 amp rate 4 hours @ 60 amp rate

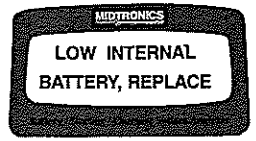
CHARGING CONSIDERATIONS

1. Batteries should not exceed 125°F during charging. If 125° F is reached, removed battery from charger.
2. Consult your NAPA battery manual for charging times that will bring batteries to an acceptable condition for introduction into service.

NOTE: *Charging times are for the CHARGE & RETEST result. Additional charging time may be required before placing the battery back into service*

INTERNAL BATTERY REPLACEMENT

The PSM2 Turbo uses a 9 volt battery to allow testing of batteries down to 1 volt. Should the battery require replacing, the display will show the following message when you connect to a battery:

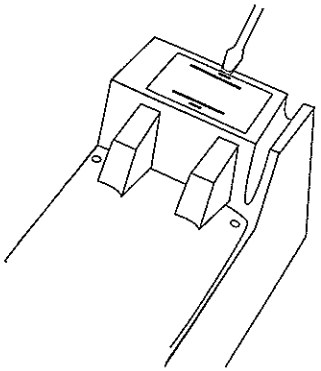


To replace the battery, follow the illustration below. The PSM2 Turbo requires a 9 volt battery (alkaline recommended), available wherever batteries are sold.

The PSM2 Turbo can test batteries down to 5.5 volts when the internal 9 volt is not functioning. It is recommened to change the battery as soon as the message is displayed.

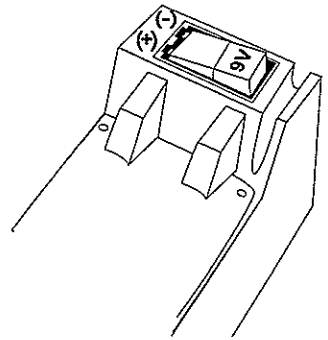
STEP 1

Remove the cover to the battery door using a small flat screw-driver.



STEP 2

Insert a 9 volt battery as shown, making sure the positive and negative terminals are placed correctly.



STEP 3

Snap the back cover into place.

BATTERY TEST RESULTS

GOOD BATTERY..... Return to service.

GOOD-RECHARGE ..... Fully charge battery and return to service. ***See charging charts in NAPA battery catalog for estimated charging time.***

CHARGE & RETEST .... Fully charge battery and retest. ***Failure to fully charge the battery before retesting may cause false readings. See charging chart in this manual for estimated quick charging time.***

REPLACE BATTERY ... Replace the battery and retest to perform a complete charging system analysis. (See note below)

BAD CELL-REPLACE .. Replace the battery and retest to perform a complete system analysis.

⚠ IMPORTANT

A **REPLACE BATTERY** result may mean a poor connection between the vehicle's cables and the battery. After disconnecting the vehicle's battery cables from the battery, retest the battery using the out-of-vehicle test before replacing.

TEST CODE

While viewing the battery test results, press the ENTER button to retreive the test code. Press the ENTER button a second time to begin the starter test. Pressing the BACK button will return you to the battery results.

For NAPA warranty adjustments, record the test code on the Warranty Adjustment Summary Form.

STARTER TEST

⚠ IMPORTANT

When testing older model diesel engines in cold weather, preheating and post heating of the glow plug may skew test results. Warm up the engine for 5 minutes then test the vehicle.

While reviewing the test code, press ENTER for the starter test. After pressing the ENTER key you will be prompted to start the engine.

At the conclusion of the test, the PSM2 Turbo will display one of the following results:

STARTER TEST RESULTS

CRANKING VOLTAGE NORMAL
The system is showing normal starter draw. Press enter to perform the charging system test.

CRANKING VOLTAGE LOW
The cranking voltage is below normal limits, troubleshoot the starter with manufacturers recommended procedure.

CHARGE BATTERY
The battery state-of-charge was too low to perform a starter test. The battery must be charged before testing the starter. Press enter to perform the charging system test, or charge the battery and retest.

REPLACE BATTERY
The battery must be replaced before testing the starter. Press enter to perform the charging system test.

If the battery is good and fully charged and the vehicle will not start, perform the steps below for further diagnosis.

With the vehicle lights on:

If the engine does not crank and the lights dim heavily, check the connections to ensure the wiring is clean and in good condition. If wiring is in good condition, repair or replace the starter.

If the engine does not crank and the lights go out,

there is probably a poor connection. Check the connection to the battery and ground and ensure they are clean and tight.

If the starter does not crank and the lights do not turn on, check for an open circuit and retest the battery to ensure it is good and fully charged. Replace any defective wiring and clean and tighten all wiring connections.

With the vehicle lights off:

If the engine cranks slowly but will not start, check all wiring to ensure it is in good condition. Make sure the cables from the starter to the battery are sized according to the manufacturer's specifications. If the engine is operating properly and the wiring is in good condition, repair or replace the starter.

If the engine cranks but does not start, check the ignition system and fuel system for other problems.

If the engine does not crank and a clicking noise is heard, check the solenoid.

CHARGING SYSTEM TEST

⚠ IMPORTANT

When testing older model diesel engines in cold weather, preheating and post heating of the glow plug may skew test results. Warm up the engine for 5 minutes then test the vehicle.

The PSM2 Turbo will walk you through the necessary steps to perform a charging system analysis. With the vehicle running, you will be asked to perform tasks necessary for the PSM2 Turbo to do the analysis.

Step 1: The PSM2 Turbo will display live alternator output voltage. Press ENTER to begin the charging system test.

Step 2: Testing at REV
The PSM2 Turbo will prompt you to rev the engine for 5 seconds. When the PSM2 Turbo has detected the rev, data is collected and the tester will show that it detected the rev. If the PSM2 Turbo does not detect that the rev occurred, it will continue to prompt you to rev the engine for 5 seconds. Once detected, press enter to continue.

NOTE: *Some 8 cylinder vehicles and older vehicles idle at a high level after starting. This can allow the tester to detect a rev without any action being taken. If this occurs, continue on with the test process. The final test results will not be affected.*

Step 3: Testing at idle
The PSM2 Turbo will analyze the charging system output at idle for comparison to other readings.

Step 4: Diode/Ripple test
The PSM2 Turbo will look for the amount of ripple from the charging system to the battery. Excessive ripple usually means one or more diodes have failed in the alternator or there is stator damage.

Step 5: Testing with accessory loads
The PSM2 Turbo will prompt you to turn on accessory loads, then test at idle, then prompt you to rev the engine for 5 seconds.

The tester will determine if the charging system is able to provide sufficient current for the demands of the vehicle's electrical system.

NOTE: *When asked to turn on the accessory loads, turn on the blower to high (heat), highbeam headlights, and rear defogger.*

DO NOT use cyclical loads such as air conditioning or windshield wipers, this will skew the results.

Step 6: Analyzing Data
The PSM2 Turbo will analyze all readings to provide the results of the charging system test.

CHARGING SYSTEM TEST RESULTS

At the conclusion of the test, the PSM2 Turbo will output one of the following results and, the idle voltage and load voltage:

CHARGING SYSTEM NORMAL\DIODE RIPPLE NORMAL
The system is showing normal output from the alternator. No problem detected.

CHARGING SYSTEM PROBLEM
A problem was detected in the charging system. The potential cause of the problems are listed on the following page.

NO CHARGING VOLTAGE
The alternator is not providing charging current to the battery. Check the belts to ensure the alternator is rotating with the engine running. If the belts are slipping or broken, replace the belts and retest. Check all connections to and from the alternator especially the connection to the battery. If the connection is loose or heavily corroded, clean or replace the cable and retest. If the belts and connections are in good working condition, replace the alternator. (In older vehicles, external voltage regulators were utilized. In these instances, only replacement of the voltage regulator may be required.)

LOW CHARGING VOLTAGE
The alternator is not providing sufficient current for the system's electrical loads and the charging current for the battery. Check the belts to ensure the alternator is rotating with the engine running. If the belts are slipping or broken, replace the belts and retest. Check the connections from the alternator to the battery. If the connection is loose or heavily corroded, clean or replace the cable and retest. If the belts and connections are in good working condition, replace the alternator. (In older vehicles, external voltage regulators were utilized. In these instances, only replacement of the voltage regulator may be required.)

HIGH CHARGING VOLTAGE
This means the voltage output from the alternator to the battery exceeds the normal limits of a functioning regulator. Check to ensure there are no loose connections and that the ground connection is normal. If there are no connection issues, replace the regulator. Since most alternators have the regulator built-in, this will require you to replace the alternator. (In older vehicles, external voltage regulators were utilized. In these instances, only replacement of the voltage regulator may be required.)

The regulator is designed to control voltage output based on the battery voltage, underhood temperature, and vehicle loads being used. In other words, it controls the maximum voltage the system can produce based upon the current needs and amount of current that can be produced by the spinning of the rotor in the alternator. The normal high limit of a typical automotive regulator is 14.7 volts +- .5. Check manufacturer specifications for the correct limit, as it will vary by vehicle type and manufacturer.

A high charging rate will overcharge the battery which may decrease its life and cause it to fail. If the battery test decision is REPLACE and the charging system test shows a HIGH CHARGING VOLTAGE, check the levels of the electrolyte in the battery. A battery condition symptom of overcharging is fluid spewing through the vent caps which causes low electrolyte levels and will harm the battery.

EXCESS RIPPLE DETECTED
One or more diodes in the alternator are not functioning or there is stator damage, which is shown by an excessive amount of AC or ripple current supplied to the battery. Check to ensure the alternator mounting is sturdy and that the belts are in good shape and functioning properly. If the mounting and belts are good, replace the alternator.

An alternator is designed to create the electrical energy necessary to charge the battery and provide for the vehicle's electrical system load. Since the alternator creates AC, (alternating current), it must be rectified into DC, (direct current), to charge the battery and supply power to the rest of the system. To accomplish this, the alternator uses diodes which allow current flow in only one direction, changing AC current to DC current. When one or more of the diodes fail, the AC ripple current from the alternator to the battery will exceed normally acceptable limits.

PRINTING/VIEW CAPABILITY

SET UP - Customized Printer Output:
The PSM2 Turbo has the capability to print the last test result. In addition, the printer output may be customized to print your store name, address, and phone number. While disconnected from a battery, press the VIEW/PRINT button and scroll to the SET USER ADDRESS screen and press ENTER. Use the arrow buttons to scroll to scroll to the appropriate screen, then press ENTER to select. A cursor is now visible. Use the arrow buttons to scroll to the