

Starting System Test

This is an excellent test to use when a “slow crank/no start” problem is encountered. It will tell you if the problem is due to an electrical open, short or high resistance in the starter circuit.

NOTE: The battery condition and the state of charge must be checked before testing the starter system.

Tool(s) required: Digital Multimeter and Inductive Ammeter (AC/DC Current Transducer).

Test instructions: Properly connect the inductive Ammeter to the multimeter (refer to the manufacturers instructions). Set multimeter on Volts scale. With the key off place the inductive ammeter around the main negative (-) battery cable and read the meter prior to activating the starter system. Adjust the meter to read zero (if applicable). Crank the engine for at least 3 seconds and record the results.

Typical Starter System Draw at 65°F (18°C)	
Groundsmaster 223-D	215A
Groundsmaster 224	110A
Groundsmaster 325-D	210A
Groundsmaster 345	75A
Groundsmaster 455-D	230A
Greensmaster 3000	85A
Reelmaster 223-D/5100-D	215A
Reelmaster 5300-D	250A
Reelmaster 335-D/3500-D	230A
Reelmaster 450-D/4500-D	300A
Workman 3200	90A
Workman 3200-D	170A
Sand Pro 5000	125A
Multi-Pro 1100	80A
Hydroject 3000	110A

Battery Test

Use a Digital multimeter to measure the voltage between the battery terminals.

Set the multimeter to the DC volt setting. The battery should be at a temperature of 60° to 100° F (19° to 38° C). The ignition key should be off and all accessories turned off. Connect the positive (+) multimeter lead to the positive battery post and the negative (-) multimeter lead to the negative battery post.

NOTE: this test provided a relative condition of the battery. Load testing of the battery will provide more accurate information.

Voltage Measured	Battery Charge
12.6 V (or higher)	Fully charged (100%)
12.4 V	75% charged
12.2 V	50% charged
12.0V	25% charged

Voltage Drop Testing

This is a simple test that should be used to locate excess resistance in an electrical circuit.

Tool required: Digital Multimeter
DC volts setting.

Test instructions: Connect the positive (+) test lead to the power (or most positive) side of the component, circuit or connection. Connect the negative (-) test lead to the ground (of least positive) side of the component, circuit of connection. Turn on the circuit to be tested and read the voltage. Remember - when performing voltage drop tests the circuit must be complete and activated to locate the resistance.

Voltage Drop Specifications (Maximums)

High Amperage Circuits (>20A)	Low Amperage Circuits (<20A)
0.4 Volt feed side	0.2 Volt feed side
0.4 Volt ground side	0.2 Volt ground side



Commercial Products

ELECTRICAL SYSTEM POCKET GUIDE

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Specific Gravity Test

The state of the battery charge is indicated by the specific gravity or weight of the battery electrolyte. Specific gravity can be measured very quickly by means of a battery hydrometer with a thermometer for temperature correction. Hydrometers are calibrated to measure specific gravity correctly at an electrolyte temperature of 80°F. To determine the correct specific gravity reading when the temperature of the electrolyte is other than 80°F: **Add** to the hydrometer reading four gravity points (0.004) for each 10°F **above** 80°F. **Subtract** four gravity points (0.004) for each 10°F **below** 80°F.

Battery Testing Chart

TEST	TEST RESULTS	CONDITION	CORRECTIVE PROCEDURE
SPECIFIC GRAVITY TEST @ 80°F	GRAVITY BETWEEN 1.250 - 1.280	CHARGED	PERFORM LOAD TEST
	GRAVITY BELOW 1.240	DISCHARGED	RECHARGE PERFORM LOAD TEST
	MORE THAN 50 GRAVITY POINTS (0.050) VARIATION BETWEEN CELLS	(A) SHORTED CELL (B) ACID LOST (C) OLD BATTERY	REPLACE

Charging System Test

This is a simple test used to determine if a charging system is functioning. It will tell you if the charging system has output, but not how much (amps) or what it is capable of.

Tool required: Digital multimeter - DC volts setting

Test instructions: Connect the positive (+) multimeter lead to the positive battery post, and the negative (-) test lead to the negative battery post. Note the battery voltage. (Open Circuit Test) Leave the test leads connected and start the engine and run at 2200 RPM minimum. Test results should be:

At least 1 volt over Open Circuit test results	
Open Circuit Test results	= 12.5 V
Charging System Test results	= 13.5 V
Difference	= +1.0 V

Battery Load Test

To test a batteries ability to deliver current under a load, use a battery load test. This test is made using a battery load tester. To test the battery connect the load tester to the battery posts and apply a current load of one-half the cold cranking amperage for 15 seconds. If the cold cranking amperage is not known, use three times the Amp-Hr rating of the battery for 12 volt batteries (two times the Amp-Hr rating for 6 volt batteries). Check the minimum terminal voltage and reference the temperature compensation chart. If the battery fails this test recharge the battery and test again.

Temperature Compensation Chart

Battery electrolyte temperature	Minimum voltage "under load" @ end of test
70°F (21 deg C)	9.6 VOLTS
60°F (16 deg C)	9.5 VOLTS
50°F (10 deg C)	9.4 VOLTS
40°F (4 deg C)	9.3 VOLTS
30°F (-1 deg C)	9.1 VOLTS
20°F (-7 deg C)	8.9 VOLTS
10°F (-12 deg C)	8.7 VOLTS
0°F (-18 deg C)	8.5 VOLTS

Schematic Symbols

