

**FAX**

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Chris S. Whiteley  
Atlantic Solar Products, INC.  
9351 J Philadelphia Rd.  
Baltimore, Maryland 21237-4114  
Ph (410) 686-2500  
FAX (410) 686-6221

Dear Chris:

I want to thank you for your quick response to my request in October for an evaluation sample of your high frequency pulse Battery Desulfator S280. Your instructions and timely response were appreciated. I am writing you this letter to document my preliminary test results to date using the desulfation unit.

I setup a simple test to evaluate how well the desulfation unit works in restoring a new battery that had failed from a 1-year storage at the Navajo Tribal Utility Authority (NTUA) warehouse. The battery was a Power Battery Co. <sup>AGM</sup> gel MC100X battery that had been previously tested and discarded because it would not accept charge or provide any discharge capacity. It was the only battery that had failed after 1-year of storage at the NTUA warehouse.

The test procedure consisted of:

- 1 Establish battery charge/discharge characteristics as-received ( $V_r = 14.1$ ).
- 2 Attach desulfation unit to battery and allow battery to rest for 128 hrs.
- 3 Conduct a charge/discharge cycle with desulfation unit to evaluate battery charge acceptance and capacity ( $V_r = 14.1$ ).
- 4 Allow battery to rest with desulfation unit for 114 hrs.
- 5 Conduct three charge/discharge cycles with desulfation unit to evaluate battery charge acceptance and capacity ( $V_r = 14.4$ ).
- 6 Terminate test.

The test results indicate that the battery initially would not accept charge or provide any discharge current. In Chart 1 are the initial battery charge/discharge characteristics in the as-received condition. The charge current after 1-hr at 14.1 volts was 0.1 amps and at the discharge current of 3 amps the battery immediately dropped below 10.5 volts, which terminates the discharge. The amp-hour charge or discharge values were too small to measure. The voltage spikes are due to the high impedance of the battery and the slow settling time of the power supply. The time above 14.1 volts was less than a few seconds.

In Chart 2 are the results of a similar cycle test after 128 hrs. on the desulfation unit. The results indicate that very little has changed since the first test. The charge current increased to 0.3 amps with a 0.3 Ah charge and the 3 amp discharge current dropped the battery voltage to 10.5 volts after a 0.4 Ah discharge. The battery voltage was monitored during the 128 hr desulfation period and it was found that initially it exceeded 15 volts, after 15 min. it dropped to 14 volts, and after 128 hrs it dropped to 12.9 volts. This is an indication of the battery's ability to accept charge.

In Chart 3 the battery is charged at 1 amp after another 114 hrs on the desulfation unit, for a total of 242 hrs. The results show a battery that is now accepting charge. The 1 amp charge rate was terminated at a battery voltage of 13.8 because the battery was beginning to go into thermal runaway. Battery temperature after the 106 Ah recharge was exceeding 40°C. Of particular interest in Chart 3 is the wavy voltage curve. This is apparently the result of the breakdown of the hardened sulfate crystals. Chart 4 shows three discharge/charge cycles that were conducted to exercise the battery. The battery was allowed to rest for 30 min. before a 4 amp discharge/charge cycle was begun. The discharge cycles were terminated at 10.5 volts. The first discharge resulted in a 48.5 Ah battery capacity. The first recharge to 14.4 volts resulted in 98.3 Ah recharged. The second and third cycles provided stable discharge/recharge cycles of -63.7, 74.2, -63.6, 74.1 Ah respectively.

A battery specification sheet from the manufacturer was requested, but I have not received it yet. At the time that I talked to Power Battery Co. they were not sure of the battery capacity. I would expect to see 70 Ah at a 20 hr rate from a gel battery like this.

In summary, the test results are encouraging and work is now under way to sulfate four JCI gel batteries to conduct a more controlled test under "normal" recharge procedures and high frequency pulse desulfation recharge procedures. Direct comparisons will be made. Testing should begin in December if the batteries sulfate well.

Sincerely,

*Tom Hund*

Tom Hund  
PV System Applications Dept.

Copy:  
All Staff

Chart 1

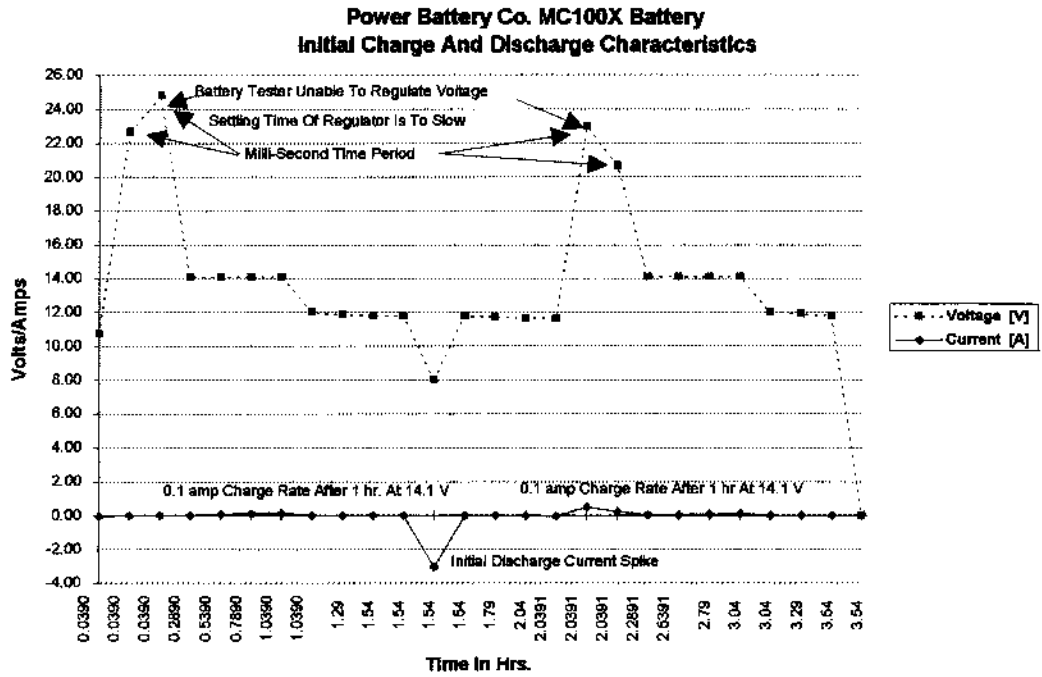
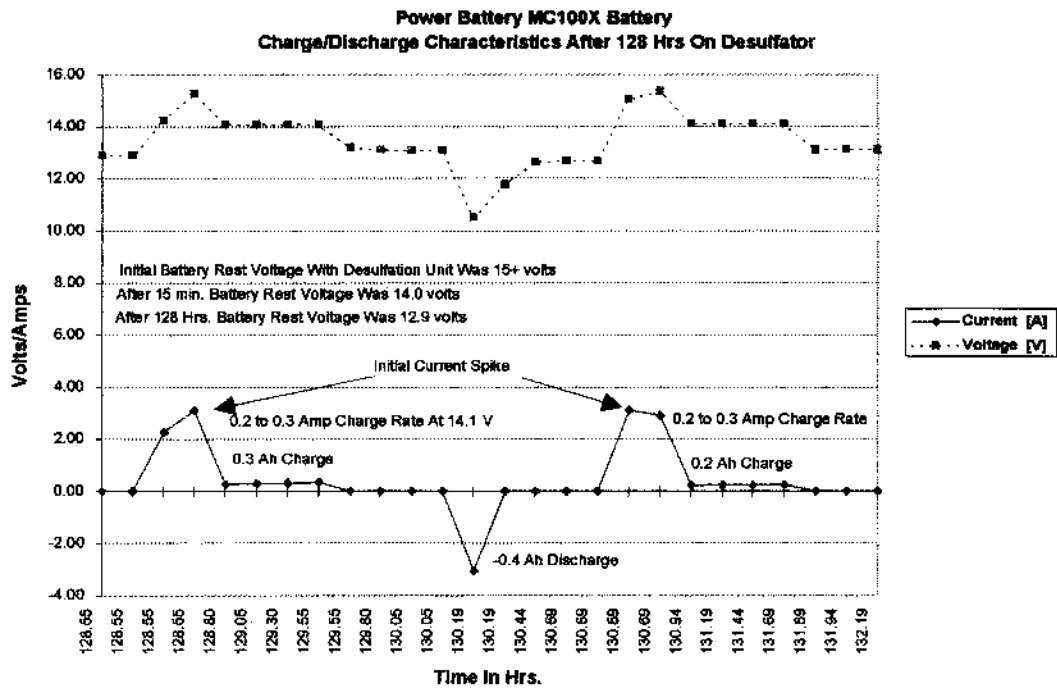
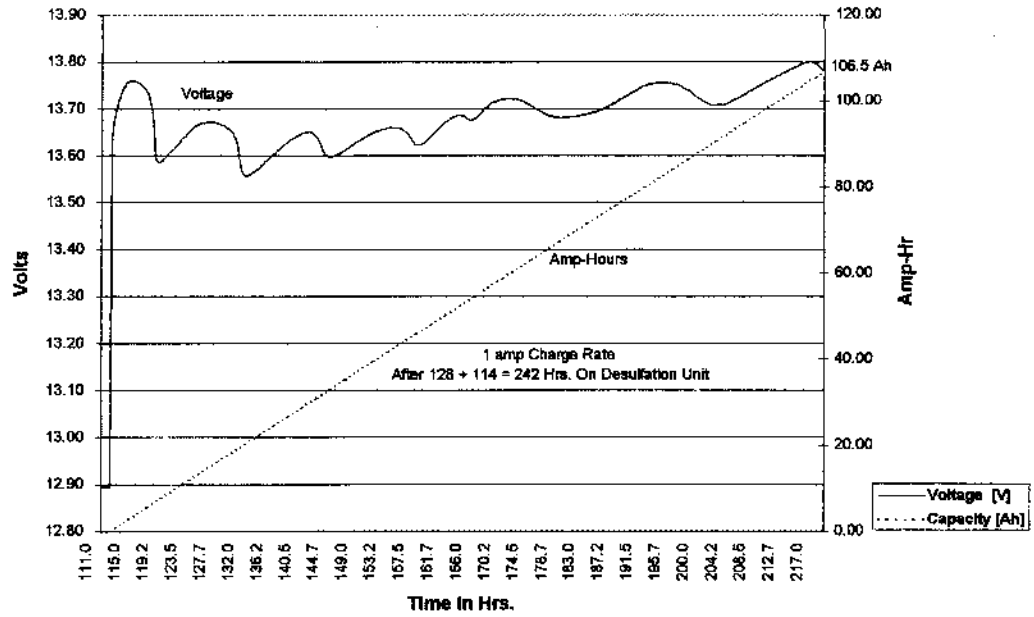


Chart 2



**Chart 3**

**Power Battery Co. MC100X Battery  
Recharge During Desulfation**



**Chart 4**

**Power Battery Co. MC100X Capacity Test  
4 amp Charge/Discharge Rate**

