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**SILVER OXIDE/ZINC RECHARGEABLE LITHIUM CELLS -
A COMPARISON WITH HIGH ENERGY DENSITY
LITHIUM/LITHIUM COBALT OXIDE**

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DENSITY LITHIUM/LITHIUM COBALT OXIDE

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FOREWORD

This report presents the results of testing 30-ampere-hour (Ah) silver oxide/zinc (AgO/Zn) cells in order to compare their performance to the same size lithium/lithium cobalt oxide ($\text{Li/Li}_x\text{CoO}_2$) cells. The work was performed for the Naval Surface Warfare Center, Dahlgren Division, White Oak Detachment (NSWCDDWODET) under contract N60921-89-D-0039.

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Approved by:



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CHAPTER 1

INTRODUCTION

Underwater vehicles have been battery powered since the late 19th century. Originally, lead-acid batteries were used. At the five to six hour rate, lead-acid batteries can provide up to 2000 cycles depending on the design, but gravimetric energy densities measured only in the teens. The mission range of an underwater vehicle powered by a battery is limited by the battery's energy density at a given power density. Smaller underwater vehicles are preferably powered by silver oxide/zinc (AgO/Zn) batteries, the only other rechargeable system used for these applications. That system was selected because it can provide three times the energy density of lead-acid.¹ No other commercially-available battery provides as high an energy per unit weight or volume. Vehicle range is thereby increased, but a severe loss in cycle life must be accepted. Under optimum conditions, AgO/Zn cells provide about 50 cycles at 50 Wh/lb. Far fewer cycles have been reported by users in the field. They have been under active development and production for half a century and have found a niche market when high cycle life and low cost are less important than energy density.

The ultimate objective of the High Energy Battery Project, supported by the Office of Naval Research, has been to develop a battery based on a more energetic couple than AgO/Zn for the Swimmer Delivery Vehicle (SDV) and other submersibles. The system selected for development was lithium/lithium cobalt oxide ($\text{Li/Li}_x\text{CoO}_2$) which included the following design goals: that it provide a minimum energy density of 100 Wh/lb over at least fifty cycles, at -2°C to 35°C , and that the battery must last five years in storage. Activities conducted under that program have been presented separately. The principal activity led to the development and evaluation of 7- to 30-ampere-hour (Ah) cells.² Another activity investigated the performance of the $\text{Li/Li}_x\text{CoO}_2$ system in cells of the size AA (American Standards Association).^{3,4} The third activity, and the subject of this report, was to clearly establish and quantify the relative advantages or disadvantages of $\text{Li/Li}_x\text{CoO}_2$ compared to AgO/Zn .

Commercial AgO/Zn cells were purchased and tested. The nominal capacity of these cells was 30 Ah, for direct comparison to 30-Ah $\text{Li/Li}_x\text{CoO}_2$ cells. Comparative data were developed for the two systems for energy density, cycle life, stability on storage, temperature dependence, and some abuse conditions. Some results were previously reported.^{5,6}

Earlier work⁷⁻⁹ on the $\text{Li/Li}_x\text{CoO}_2$ system, demonstrated its unique characteristics: high energy density, high cell voltage, excellent rate capability, and good reversibility. As a result of these studies, the baseline system was defined. The cell reaction is given by Equation 1-1.



On discharge, lithium metal is oxidized at the anode to lithium ions which dissolve in the electrolyte. Correspondingly, lithium ions are reduced at the cathode and inserted (intercalated) into the crystal lattice of Li_xCoO_2 . At full discharge, the value of x in Li_xCoO_2 is unity. One Faraday per mole (1 F/M) would be transferred if the initial value of x were zero and the final value one (one electron transferred). To achieve consistent capacity over about fifty cycles, however, the range of x must be limited to between 1.0 and about 0.5.

The exact reactions occurring on discharge at the silver oxide cathode are still under study, and the products of the zinc anode are rate dependent.¹⁰ For purposes of this report, zinc hydroxide, Zn(OH)_2 , is assumed the only product. The overall cell reaction then may be written as in Equation 1-2.



The discharge product at the cathode, silver (Ag), has limited solubility in the electrolyte and remains essentially as a solid. At the anode, after zinc ions have saturated the electrolyte (first discharge), the discharge product remains a solid.

Design requirements for satisfactory state-of-the-art AgO/Zn cells are well known. A primer has been published by A. Himy.¹¹

CHAPTER 2

EXPERIMENTAL

Cell comparisons between different battery systems are not straight-forward. This section describes the approach used to normalize the performances generated by the AgO/Zn and Li/Li_xCoO₂ cells. In addition, it describes the preparation of the silver cells for those unfamiliar with these cells as provided in the active and dry unformed state. It also includes the reasoning behind the capacity ratings of the commercial and developmental cell. Finally, the testing methodology is presented, and a test matrix developed.

CELL PREPARATION

Sixty Model LR30 AgO/Zn cells were purchased from Yardney Technical Products Inc., Pawcatuck, Connecticut. Half of the cells were ordered in the active state, *i.e.*, the cells contained electrolyte and had been charged. These cells (Cell Nos. 28-60) were used for the first tests. Cells that were not tested immediately (because cycling stations were unavailable) were sealed in plastic bags and stored at -18°C. No active cells were stored more than two months.

For later testing, "dry unformed" cells (Cell Nos. 1-27) completed the order. These contained electrodes of silver and zinc oxide, but the electrolyte was shipped in a separate container. The cells were activated by adding the electrolyte, and after a soak period to allow the cell components to fully wet, they were charged (*i.e.*, Equation 1-2 is driven to the left). This first charge is called the "formation charge." The first discharge ("formation discharge") verified that the cell was fully formed. If not, additional formation charge/discharge cycles were applied.

Before adding electrolyte to the cells, they were constrained to prevent bulging of the case walls parallel to the surfaces of the plates. Wood planks were strapped onto the cells to completely cover these faces. That procedure and the subsequent formation were performed in accordance with the supplier's instructions.¹² A synopsis of the process is: (1) charge at 1.5 amperes (A) to 2.05 volts (V), (2) stand on open circuit for one hour minimum, (3) discharge at 15 A to 1.10 V or to deliver 35 Ah, whichever occurs first. Most of the cells delivered the required capacity on the first discharge. The formed cells stood on open circuit for four days to equilibrate before going on test.

The weights of active and formed charged cells are given in Table 2- 1. The cells averaged 499.74 grams, or approximately 1.1 pounds.

AgO/Zn CELL DESIGN AND RATINGS

Technical information for Yardney's Model LR30, is reproduced below from the manufacturer's brochure.¹³ *

Electrical Characteristics

Nominal capacity: 30 Ah,
Recommended charge rate: 1.5 A (20-Hour Rate).

Application Data at 70°F (22°C)

A. When discharged at the 10-hour rate (3.0 A):

capacity: 46 Ah ,
average voltage: 1.53 V,
gravimetric energy density 63 Wh/lb (139 Wh/kg),
volumetric energy density: 4.5 Wh/in³ (275 Wh/L).

B. Discharge at the maximum continuous current (75 A):

capacity: 28 Ah,
average voltage: 1.29 V

Physical Characteristics

A photograph of one of the cells is shown in Figure 2-1. Physical characteristics include:

maximum weight filled: 1.11 lb (502 g),
overall volume: 15.7 in³ (257 cm³),
overall height: 7.5 in (19 cm),
width: 2.01 in (5.11 cm),
depth: 1.04 in (2.64 cm).

The reader who is not familiar with industry practice may be confused because the nominal, or rated, capacity (30 Ah) is different from the 46 Ah capacity cited for the ten hour (3 A) rate. This is because the cell design must address the minimum acceptable capacity for a given application and required cycle life. Himy¹⁴ explains the approach:

*The manufacturer's brochure includes the following note, "The data in this brochure represents general performance characteristics of cells of the silver-zinc alkaline system and should be regarded only as a guide."

What interests the designer and ultimately the user is the capacity needed for the application; the capacity the customer is ordering; and the capacity the application engineer requires for his device, appliance, or system. It is designated the rated capacity Q_R . This capacity is the minimum required of the cell when purchased and tested for the first time.

It should not be equated with the original or initial capacity Q_O , which is the actual capacity of the cell during the first discharges (within three cycles). Obviously, Q_O must always be greater than Q_R . The cell is originally overdesigned by a margin that depends on the application, the calendar life or the cycle life required, and particularly on how well and how long the design or the electrodes can maintain the capacity of the cell over its successive cycles.....When talking of energy density, it should be specified whether it is based on *rated* capacity or *original* (initial) capacity, which is the highest of all cycles.

The energy density stated above for the ten hour rate is based on the original (initial) capacity. The manufacturer's literature¹³ includes a figure that shows the capacities obtained at the 10-minute, 20-minute, 1-hour, and 10-hour rates as a percentage of the nominal capacity. At the 20-minute rate, 100 percent of the nominal capacity is obtained. Interpreting the figure, the 20-minute rate is the "C" rate, as defined below.

Using the rated capacity rather than the initial capacity, the gravimetric and volumetric energy densities are 41 Wh/lb (90 Wh/kg) and 2.9 Wh/in³ (177 Wh/L), respectively. It should also be noted that if the cells are cycled to discharge the nominal capacity each cycle, the silver oxide electrode (which limits the cell capacity¹⁵) is only discharged initially to a 30/46 depth. That fraction increases with cycle number as the actual capacity decreases. The number of cycles to the cutoff capacity is inversely related to the depth of discharge.¹⁴

Li/Li_xCoO₂ RATINGS

In contrast to the more practical assignment of capacities for AgO/Zn cells, the capacities of the Li/Li_xCoO₂ cells were determined from the weight of LiCoO₂ in the manufactured cathodes and assuming discharge from Li_{0.5}CoO₂ to Li_{1.0}CoO₂. It should be obvious that by so defining the capacity, no allowance is given for capacity deterioration on cycling because, in contrast to AgO/Zn, the cathode is fully discharged each cycle. Cycle life, therefore, was obtained under the most severe condition.

C/n RATINGS

A common practice is used in this report to represent charge and discharge rates. That practice describes the rate in amperes, in terms of the number of hours, n , required to charge or discharge the cell capacity, C_M , as in Equation 2-1.

$$I = C_M/n \quad (2-1)$$

The capacity, C_M , is the total ampere hours delivered to a given cutoff voltage over the period of m hours. It usually is the rated capacity (Himiy's " Q_R "). For Yardney's AgO/Zn cells,¹³ the twenty

minute rate delivers C, and Equation 2-2 applies.

$$C_M = C_{1/3} \quad (2-2)$$

As an example, returning the nominal 30-Ah capacity in 13 hours would dictate charging at the $C_{1/3}/13$ rate.

For the $\text{Li/Li}_x\text{CoO}_2$ cells, the capacity used to specify C is the Faradaic equivalent of half the mass of Li_xCoO_2 . Since that capacity can only be delivered under totally chemically-reversible conditions, Equation 2-3 applies.

$$C_M = C_\infty \quad (2-3)$$

At the practical rates used in this study, the reversibility and other factors affecting the reactions result in about 98 percent of the charge capacity returned on discharge over much of the cycle life.

Having defined M for the two different cell types, for simplicity, the subscripts are dropped in the following text. The symbol C replaces $C_{1/3}$ in discussions concerning the AgO/Zn cells, and C is used instead of C_∞ for discussions concerning the $\text{Li/Li}_x\text{CoO}_2$ cells.

TEST MATRIX

Table 2-2 shows the test matrix for the AgO/Zn cells. Fresh cells were evaluated at one rate of discharge (C/6), two charging rates (C/30, C/10), and three temperatures (-2°C , 23°C , 35°C). Discharge was terminated either when the cell delivered the 30-Ah nominal capacity or when the voltage dropped to 1.1 V, whichever came first. Charging was stopped when the cell voltage rose to 2.05 V, per the manufacturer's recommendation.¹² The C/6 discharge rate represents the specification¹⁶ for the present SDV battery, as do the temperature extremes.* Yardney advises that their AgO/Zn cells "can be fully recharged within 10 hours, depending on requirements and type of cell."¹³ Manufacturers generally recommend a charging rate for each model which depends on the cell design, especially electrode area.¹⁷ The recommended rate for Yardney's LR30 is 1.5 A (C/20).¹³

A lower charging rate, C/30, was used for some cells to obtain data under conditions less taxing to them. (This rate is also used for the first article and lot acceptance testing for the present SDV battery.¹⁶) Generally, however, the cells were cycled using the C/10 rate for three reasons: it reportedly fully recharges the cell;¹³ it is the same charging rate that was used for the $\text{Li/Li}_x\text{CoO}_2$ cells;² and it is practical for field conditions.

*The cells for the vehicle are nominally 360 Ah capacity. Over the temperature range 28 to 100°F , cells discharging at 60 A are to provide 400 Ah for cycles 1-2 and 300 Ah minimum for cycles 3-50.

Except for the conditions shown for the two- and three-months storage, the cycling tests were conducted with the cells at the specified temperature during charge, stand, and discharge. While those temperatures might be experienced during discharge in the field, it is the more usual field practice to charge about 25°C. In fact, the manufacturer¹² recommends against charging beyond the range 21-32°C. Himy¹⁸ recommends 10-35°C. The high temperature used during cycling was marginally acceptable *vis-à-vis* the recommendations. Low temperature charging may have overtaxed the cells.

The test matrix emphasized cell performance after storage. Some cells stood for 100 hours between charge and discharge. Other cells were stored at 22°C or 35°C, either charged or discharged. These cells were previously cycled or fresh. After storage, the cells were returned to the selected cycling regime.

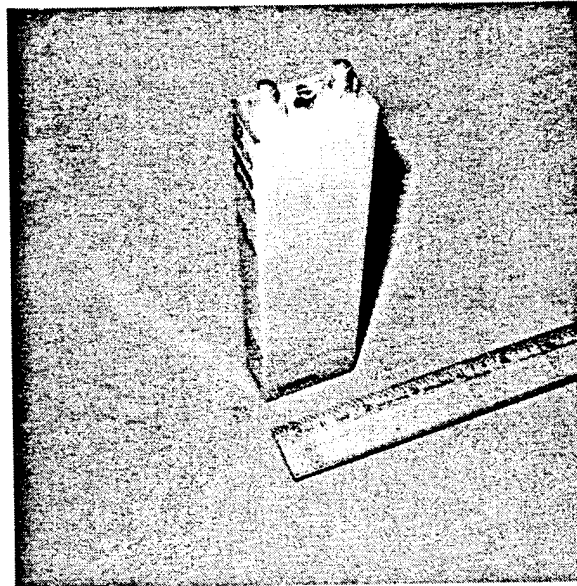


FIGURE 2-1. 30-Ah SILVER OXIDE/ZINC CELL, YARDNEY TECHNICAL PRODUCTS, INC. MODEL LR30

TABLE 2-1. WEIGHTS OF 30-Ah AgO/Zn CELLS						
Cell No.	Fill Date	Empty Cell Wt., g	Electrolyte Wt., g	Filled Cell Wt., g	Cell No.	Filled Cell Wt., g
1	10-12-90	378.52	121.15	499.67	28	500.40
2	10-12-90	376.24	121.83	498.07	29	497.34
3	10-12-90	378.84	121.86	500.70	30	501.52
4	10-18-90	372.74	121.62	494.36	31	501.46
5	10-18-90	378.50	123.13	501.63	32	497.47
6	10-18-90	378.14	122.12	500.26	33	499.85
7	9-10-90	377.75	121.18	498.93	34	500.03
8	9-10-90	380.17	119.97	500.14	35	501.87
9	9-10-90	378.35	121.44	499.79	36	501.37
10	10-12-90	380.31	119.50	499.81	37	-----
11	10-12-90	380.77	121.49	502.26	38	-----
12	10-12-90	378.08	125.86	503.94	39	-----
13	10-23-90	378.78	121.37	500.15	40	499.44
14	10-23-90	375.45	121.77	497.22	41	497.70
15	10-23-90	379.03	121.16	500.19	42	499.42
16	9-12-90	376.23	120.04	496.27	43	499.61
17	9-12-90	380.73	121.02	501.75	44	501.38
18	9-12-90	378.94	121.30	500.24	45	500.10
19	11-30-90	376.64	121.76	498.40	46	499.38
20	12-07-90	378.58	123.27	501.85	47	499.08
21	12-07-90	377.53	121.05	498.58	48	502.20
22	8-16-90	-----	-----	-----	49	497.24
23	8-16-90	-----	-----	-----	50	499.21
24	8-16-90	-----	-----	-----	51	500.60
25	11-30-90	379.09	121.67	500.76	52	504.58
26	11-30-90	376.42	122.37	498.79	53	501.53
27	11-30-90	374.98	122.09	497.07	54	498.95
					55	496.07
					56	498.31
					57	502.85
					58	-----
					59	-----
					60	497.00
Average		377.95	121.67	499.62		499.86
Average Cell Weight: 499.74						

TABLE 2-2. TEST MATRIX OF 30-Ah AgO/Zn CELLS

Cell Nos.	Cell Condition before Test	Test Temp., °C	Discharge Rate, A	Charge Rate, A	Hours on OCV after Charging
1, 2, 3	Fresh	-2	C/6	C/30	100
4, 5, 6	Fresh	35	C/6	C/30	100
7, 8, 9	Fresh	23	C/6	C/30	100
10, 11, 12	Fresh	-2	C/6	C/10	100
13, 14, 15	Fresh	35	C/6	C/10	100
16, 17, 18	Fresh	23	C/6	C/10	100
19, 20, 21	2 months storage, 23°C, fully discharged.	23	C/6	C/10	---
22, 23, 24	Fresh	35	C/6	C/10	---
25, 26, 27	3 months storage, 23°C, fully charged, after 11th charge	35	C/6	C/10	---
28	Abuse Test: Overdischarge				
31	Abuse Test: Overcharge				
35, 36	Abuse Test: Short				
46, 47	3 months storage, 23°C, fully discharged.	23	C/6	C/10	---
48, 49	3 months storage, 35°C, fully discharged.	23	C/6	C/10	---
50, 51	3 months storage, 23°C, fully charged.	23	C/6	C/10	---
52, 53	3 months storage, 35°C, fully charged.	23	C/6	C/10	---
54, 55	3 months storage, 23°C, fully discharged, after 4 cycles	23	C/6	C/10	---
56, 57	3 months storage, 35°C, fully discharged, after 4 cycles	23	C/6	C/10	---
58, 59	Fresh	-2	C/6	C/10	---
60	Fresh	23	C/6	C/10	---

CHAPTER 3

RESULTS AND DISCUSSION

Data were obtained to enable a comparison of performances of AgO/Zn cells to Li/Li_xCoO₂ cells at the same temperatures and rates of charge and discharge. Results for freshly-activated cells were compared to those for cells after storage in both the charged and discharged state.

DATA PRESENTATION

The following discussion of the data first treats the experiments on fresh cells, then stored cells. Conforming to the objective of the work, data were analyzed only to compare the two battery types, because the general performance of AgO/Zn batteries has been extensively treated in the literature.^{10,11,13,19,20-23} Sheets presenting raw test data for the cells have been attached as Appendix A to permit further analyses and for reference in the following discussions. Evident from Tables 2-2 and 3-1, performance under the test conditions was evaluated in duplicate or triplicate and is reported individually for each cell. In the figures, the curves are for a single cell that typifies the group. Table 3-1 presents a complete performance summary for all the cells. Useful life of a cell was assumed to be over at the cycle when only 80 per cent of the nominal capacity was delivered, *i.e.*, at 25 Ah. The same criterion was applied to the 30-Ah Li/Li_xCoO₂ cells. However, cycling was not usually terminated at that cycle.

FRESH CELL PERFORMANCE

Overall, fresh cells provided an energy density of 40 Wh/lb when cycled to deliver 30 Ah using the regime of C/10 charge, C/6 discharge. Over the temperature range that was investigated, -2°C to 35°C, the most significant performance degradation was displayed by cells charged and discharged at -2°C, while cell performance at 35°C was the best. Figures 3-1, 3-2, and 3-3 show the effect of temperature on cycle life, first discharge profile (voltage vs. amp-hours), and twentieth discharge profile, respectively. The curves represent Cell No. 59, cycled at -2°C; No. 60, at 23°C; and No. 22, at 35°C. Figure 3-4 shows additional discharges for Cell No. 60 to illustrate the fall-off in capacity with cycling.

The effect of temperature is shown also in Figures 3-5, 3-6, and 3-7, but for these cells, the C/30 charging rate was used, and there was a 100 hour delay after charge before the first

discharge. Cell No. 1 was cycled at -2°C ; No. 9, at 23°C ; and No. 4 at 35°C . The stand time was expected to reduce the performance due to self-discharge of the cell. The data at 35°C and for a C/10 charge (Table 3-1) show that there was a reduction in cycle life from 40-42 cycles (Cell Nos. 22-24) to 26-35 cycles (Nos. 13-15) as a result of the stand time. Any loss in energy density, however, was more than compensated by charging at the lower rate (Nos. 4-6).

Significantly greater cycle lives were obtained at the lower temperatures by charging at the lower rate. In Table 3-1, compare cells Nos. 16-18, which, at 23°C , gave 33-36 cycles at the C/10 rate, with up to 50 cycles for Cell Nos. 7-9 at the C/30 rate. Similarly, at -2°C , compare data for Cell Nos. 10-12 to Cell Nos. 1-3. At the lower temperatures, the 100 hour stand did not affect performance. Compare, at -2°C , Cell No. 59 to Cell Nos. 10-12, and at 23°C , Cell No. 60 to Cell Nos. 16-18. These data demonstrate that self discharge is accelerated at elevated temperature.

STORED CELL PERFORMANCE

Cells were stored and subsequently cycled using the C/10 charge, C/6 discharge regime. Figure 3-8 presents plots of capacity vs. cycle number at 23°C for Cell Nos. 46-49. These cells began cycling after three months of storage in the discharged state. Cell Nos. 46 and 47 had been stored at room temperature, while Cell Nos. 48 and 49 were stored at 35°C . Comparing the results to that obtained for a fresh cell (Figure 3-1) at 23°C , it is apparent that storage degraded cycle life.* At room temperature, the degradation apparently occurs before the end of the second month on storage. Fresh cells delivered 32-36 cycles at 23°C (Cell Nos. 16-18 and 60 in Table 3-1). Discharged cells, Cell No. 19 and Cell No. 21 delivered 23 and 24 cycles, respectively, after two months. After three months, Cell Nos. 46 and 47 delivered 28 and 24 cycles, respectively, nearly identical to the loss after two months. As shown by the curves in Figure 3-9 (Cell Nos. 55-57), storage at either temperature of cells which were cycled a few times resulted in poorer subsequent cycle lives.

Storage in the charged state severely degenerated cell performance at the same cycling regime, at 23°C . Figure 3-10 shows the cycling performance of cells stored for three months either at room temperature or 35°C . After storage at room temperature, Cell Nos. 50 and 51 delivered only 20 Ah. Storage at the elevated temperature reduced capacity to about 15 Ah (Cell Nos. 52 and 53). The lost capacity was recovered slightly on the next cycle or two but then continuously declined. (See data sheets, Appendix A.) Around cycle number 40, the charging rate was dropped to C/30 in an attempt to restore some lost capacity. Only a marginal 2-10 per cent improvement resulted.

Cell Nos. 25-27 were stored for three months after the eleventh charge. They were cycled at 35°C and, respectively, provided 24, 15, and 24 cycles. The test matrix, does not allow a

*The dip in capacity of Cell No. 46 is an artifact. An examination of the data for this cell, see appendix, reveals that a bad terminal caused fluctuations in voltage during several cycles including cycle 20.

decision as to whether the higher test temperature or the pre-cycling caused an improvement in the performance.

PERFORMANCE UNDER ABUSE

A limited number of tests were carried out to evaluate the ability of AgO/Zn to withstand the abusive electrochemical treatments of overcharging, overdischarging, and short circuiting. Cell No. 31 was overcharged by continuation of charging after 100 percent of the discharge capacity was returned. It was intended that an additional 200 percent of the discharged capacity would be returned. The cell overheated and vented before the intended full amount of overcharge. The heat was sufficient to boil the electrolyte and melt and deform the cell case.

Short circuiting of Cell Nos. 35 and 36 also overheated the cells with the same effect. On the other hand, Cell No. 28 was overdischarged to deliver 150 per cent of the nominal capacity, and the cell remained intact throughout the course of the test.

COMPARISON TO Li/Li_xCoO₂

The AgO/Zn cells were tested to directly compare their performance to that of Li/Li_xCoO₂. Parameters compared were energy density, capacity fade with cycling, and capacity loss on storage. For the silver system, the energy density at each cycle was calculated by multiplying the capacity at that cycle (see Appendix A) by the midpoint voltage (Table 3-1), and dividing by the average cell weight of 1.1 pounds. Data are given in Figures 3-11 to 3-13 for temperature 35°C, 23°C, and -2°C, respectively. These may be compared to data² for the 30-Ah Li/Li_xCoO₂ cells also given in the figures.

While discharging at almost 50 per cent higher energy density, Li/Li_xCoO₂ cells showed comparable cycle lives to AgO/Zn at 35°C. At 23°C, the lithium cells had better cycle lives. At -2°C, however, the silver cells provided only a quarter of the cycles given by lithium. Furthermore, the lithium cells showed almost no change in performance with temperature. As discussed above, the AgO/Zn system may have been particularly degraded by charging at the low temperature.

Capacity retention on storage has been presented for AgO/Zn. Data for cells stored at 23°C are plotted in Figures 3-8 to 3-10. The data are replotted in Figure 3-14; but, differing from prior practice, per cent capacity is plotted instead of actual capacity. That allows for normalization of the data for silver and lithium cells. Also in the interest of normalization, the first twenty-five cycles are shown even though they may correspond to below cutoff voltage capacities. Figure 3-15 shows data for cells stored at 35°C. It includes AgO/Zn data previously given in Figures 3-8 to 3-10. Both Figures 3-14 and 3-15 include data² for 30-Ah Li/Li_xCoO₂ cells. In stark contrast to AgO/Zn, Li/Li_xCoO₂ is not permanently degraded by any storage condition. As for the silver system, self discharge of charged cells occurs; but, in contrast to AgO/Zn, it is recovered on the first charge.

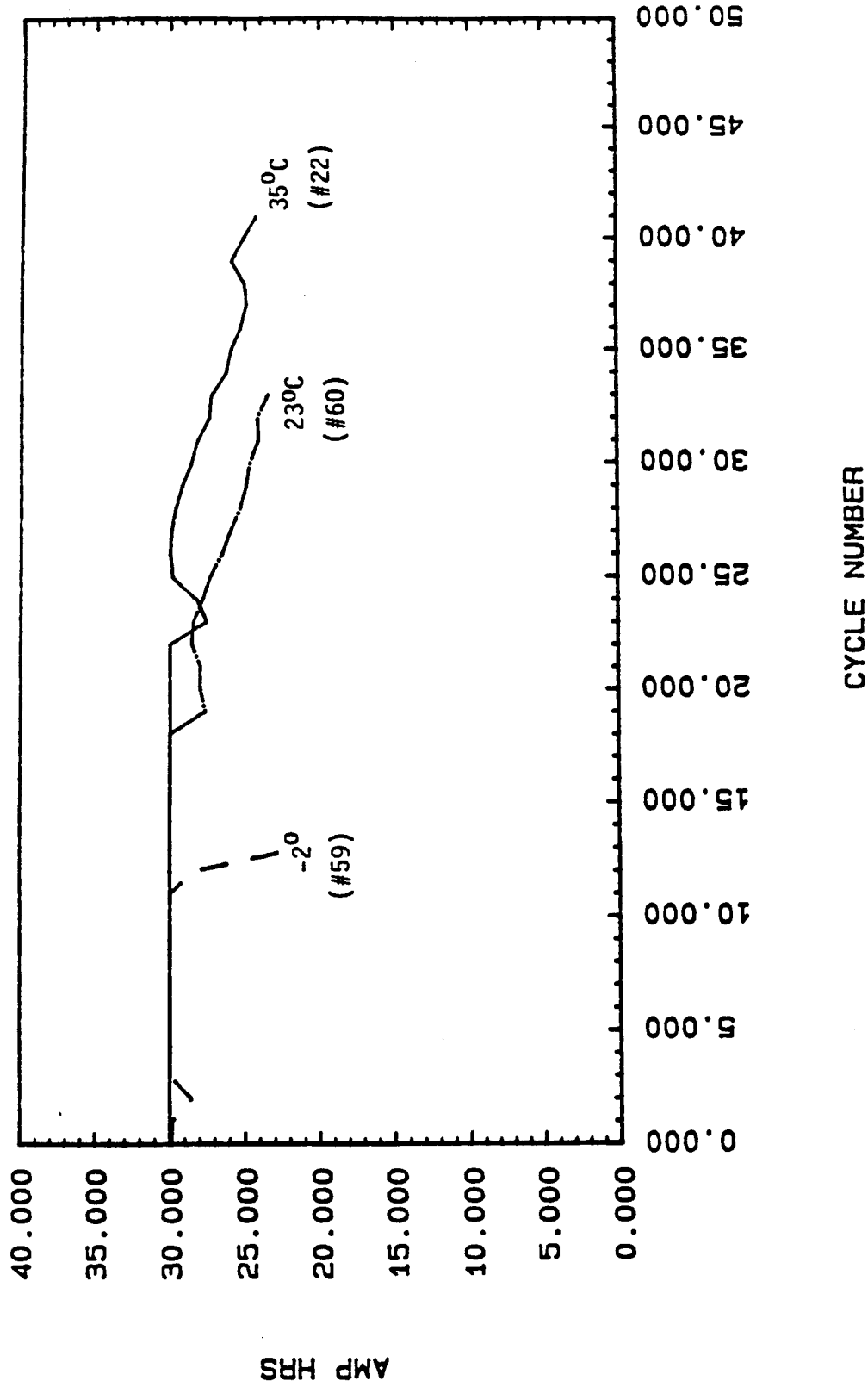


FIGURE 3-1. 30-Ah SILVER OXIDE/ZINC FRESH CELLS, DISCHARGE CAPACITY VS. CYCLE NUMBER, AT -2°C (CELL NO. 59), 23°C (CELL NO. 60), AND 35°C (CELL NO. 22); CYCLING REGIME: CHARGE RATE, C/10, DISCHARGE RATE, C/6

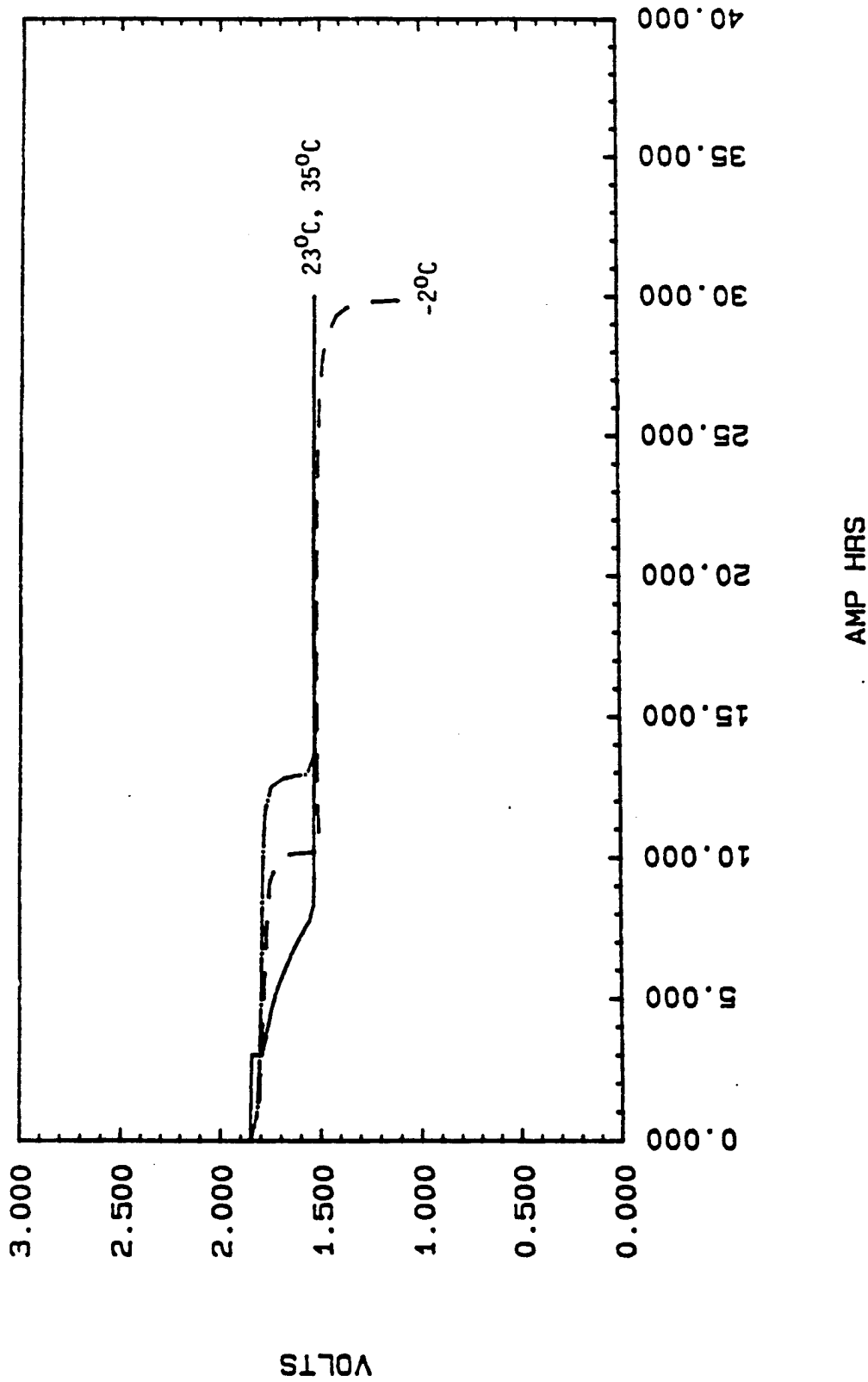


FIGURE 3-2. 30-Ah SILVER OXIDE/ZINC CELLS, FIRST DISCHARGE CURVES, VOLTAGE V/S. AMPERE-HOURS, AT -2°C (CELL NO. 59), 23°C (CELL NO. 60), AND 35°C (CELL NO. 22); DISCHARGE RATE, C/6, AFTER CHARGE AT C/10 RATE

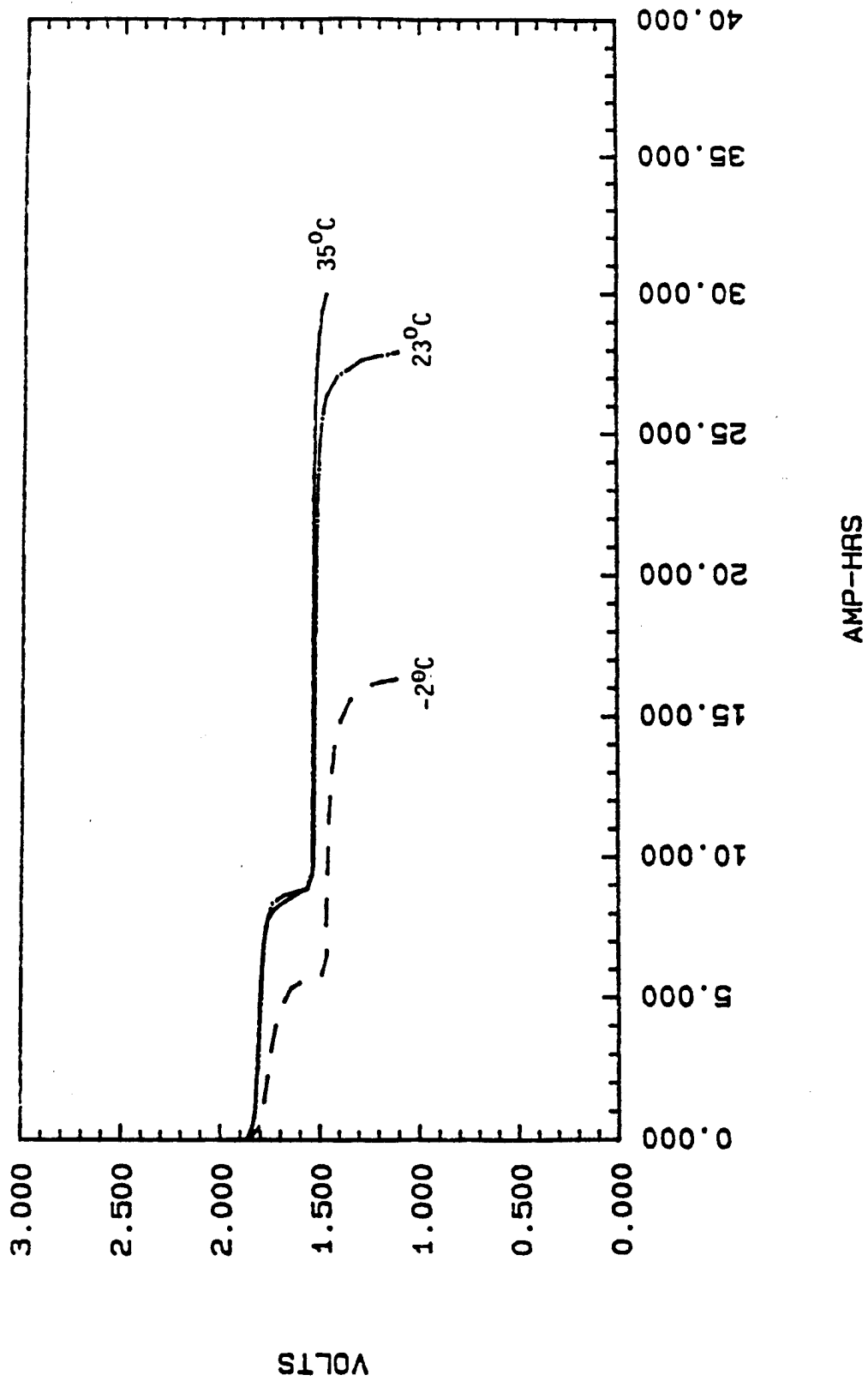


FIGURE 3-3. 30-Ah SILVER OXIDE/ZINC CELLS, TWENTIETH DISCHARGE CURVES, VOLTAGE V/S. AMPERE-HOURS, AT -2°C (CELL NO. 59), 23°C (CELL NO. 60), AND 35°C (CELL NO. 22); CYCLING REGIME: CHARGE RATE, C/10, DISCHARGE RATE, C/6

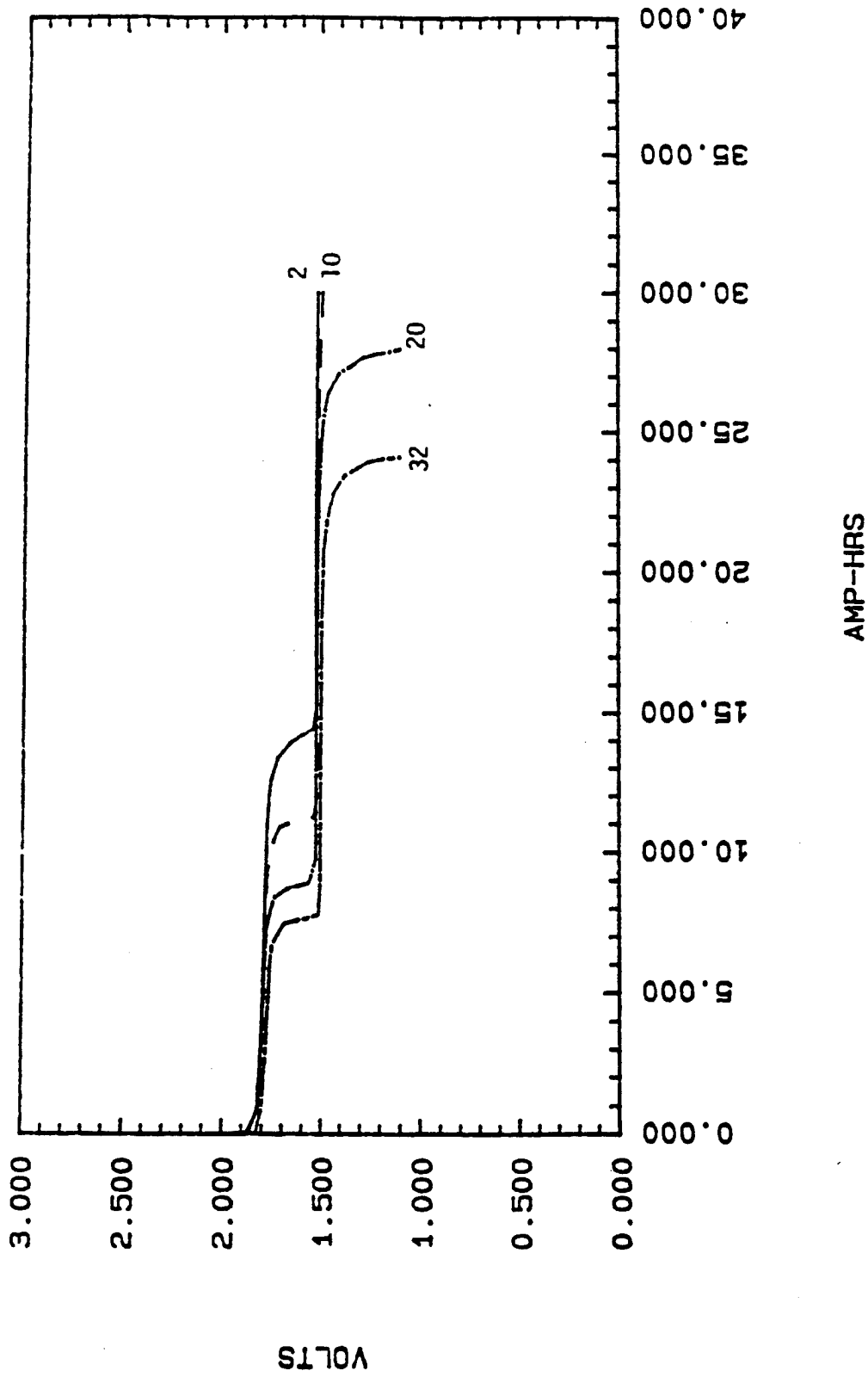


FIGURE 3-4. 30-Ah SILVER OXIDE/ZINC CELL NO. 60, DISCHARGE CURVES, VOLTAGE V/S. AMPERE-HOURS, 23°C, AT CYCLE NOS. 2, 10, 20, AND 32

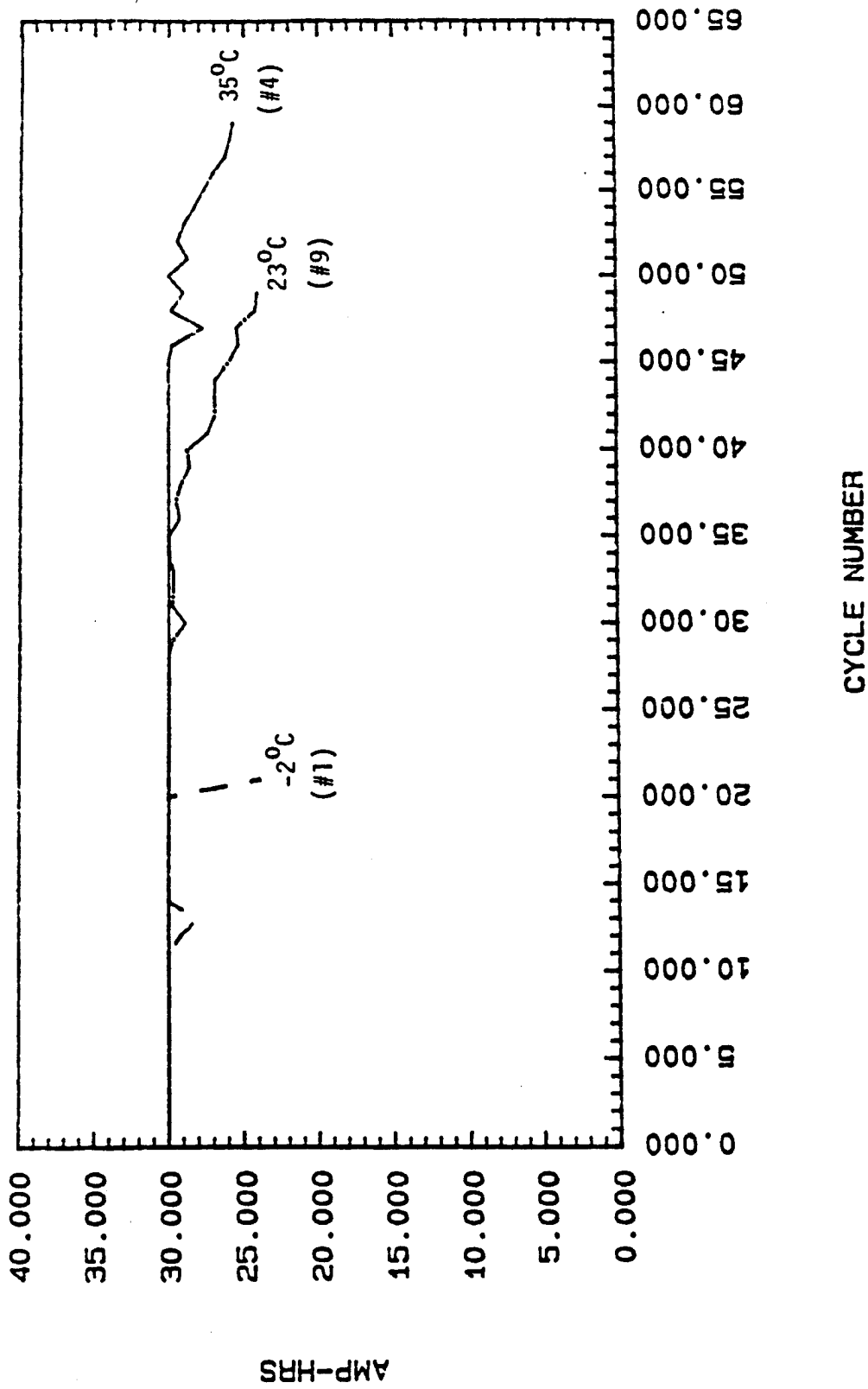


FIGURE 3-5. 30-Ah SILVER OXIDE/ZINC FRESH CELLS, DISCHARGE CAPACITY VS. CYCLE NUMBER, AT -2°C (CELL NO. 1), 23°C (CELL NO. 9), AND 35°C (CELL NO. 4); CYCLING REGIME: CHARGE C/30 RATE, 100 HOURS OPEN CIRCUIT, DISCHARGE C/6 RATE

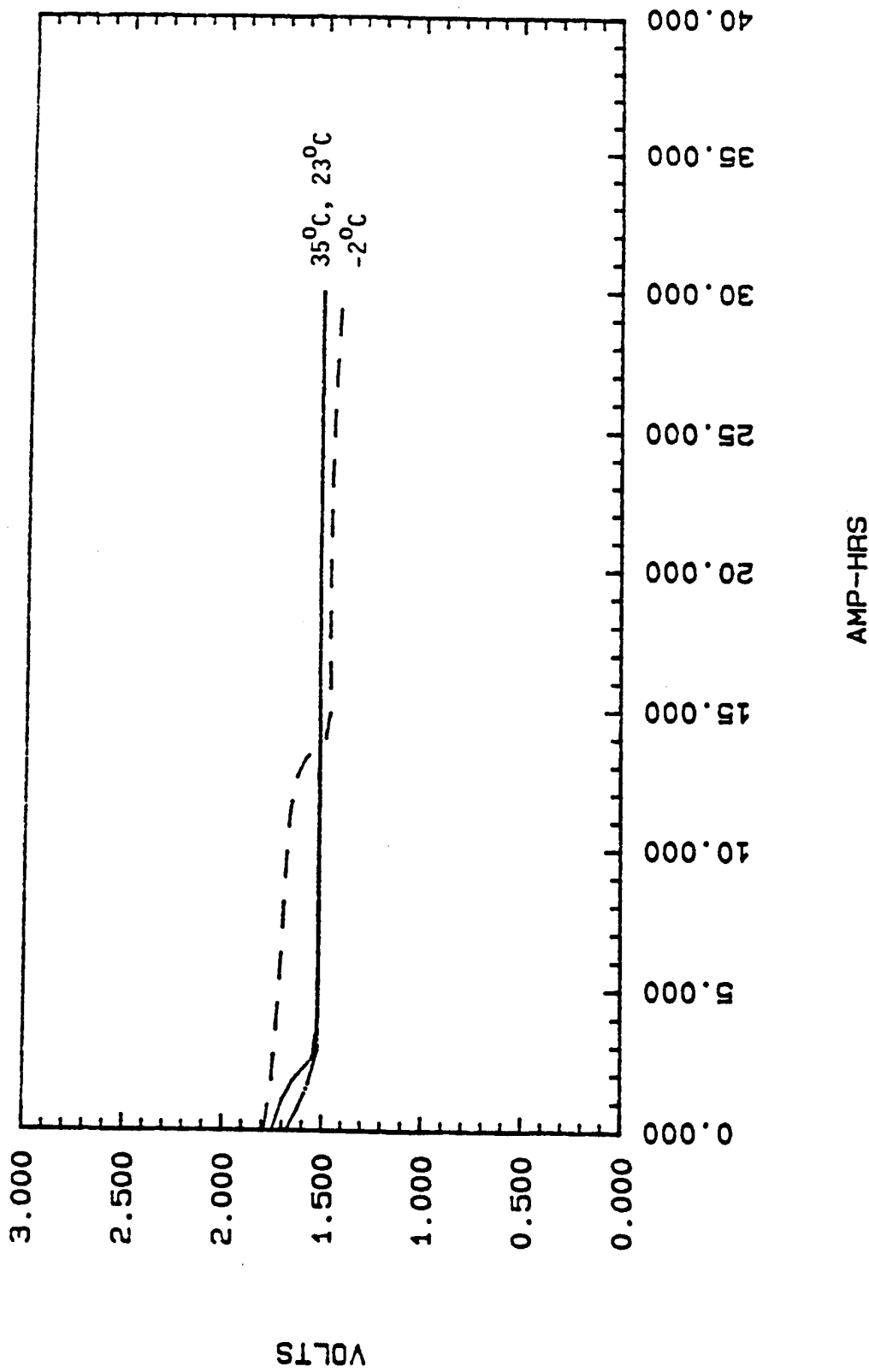


FIGURE 3-6. 30-Ah SILVER OXIDE/ZINC CELLS, FIRST DISCHARGE CURVES, VOLTAGE VS. AMPERE-HOURS, AT -2°C (CELL NO. 1), 23°C (CELL NO. 9), AND 35°C (CELL NO. 4); DISCHARGE RATE, C/6, AFTER CHARGE AT C/30 AND 100-HOUR STAND ON OPEN CIRCUIT

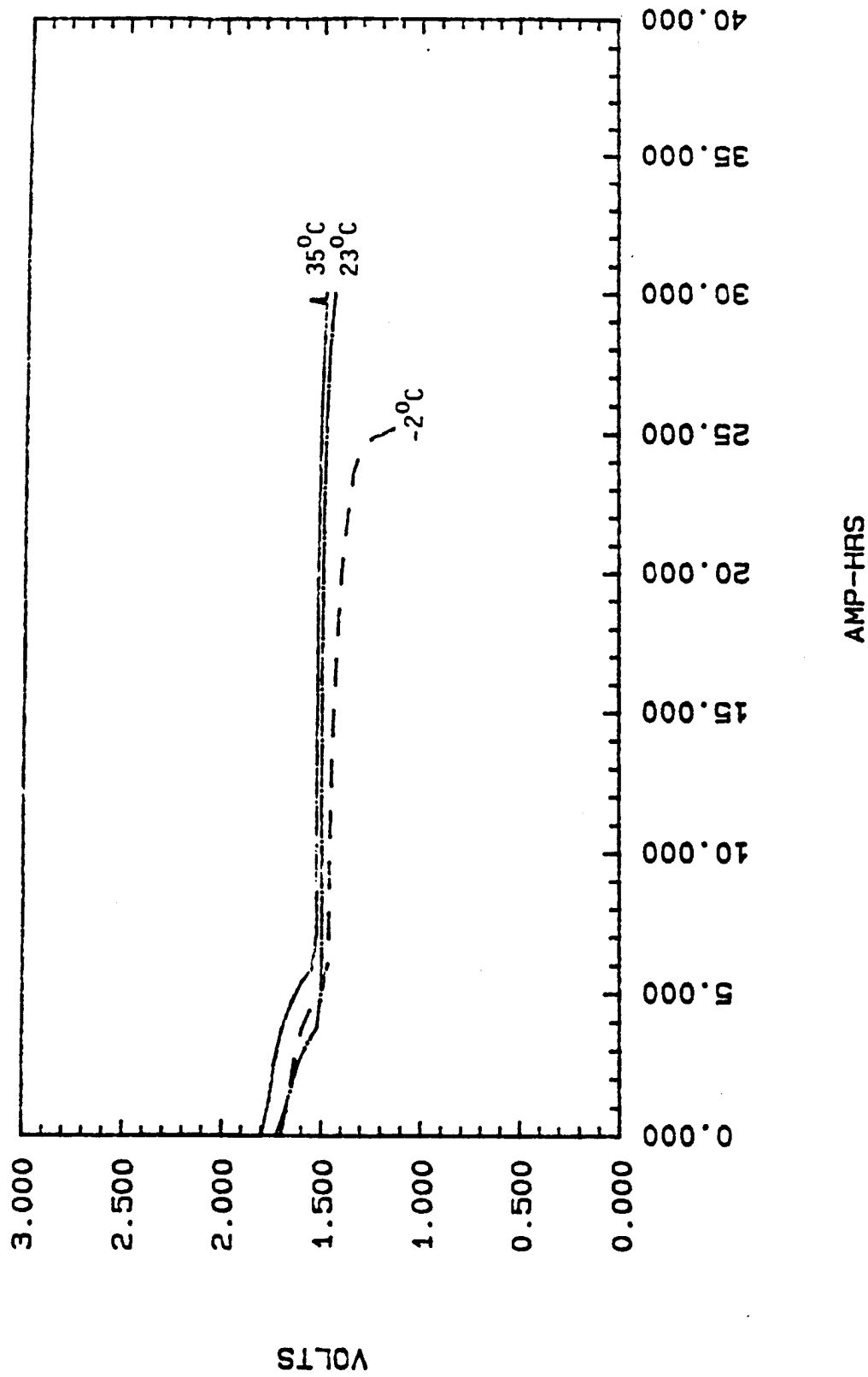


FIGURE 3-7. 30-Ah SILVER OXIDE/ZINC CELLS, TWENTY-THIRD DISCHARGE CURVES, VOLTAGE V/S. AMPERE-HOURS, AT -2°C (CELL NO. 1), 23°C (CELL NO. 9), AND 35°C (CELL NO. 4); CYCLING REGIME: CHARGE C/30 RATE, 100 HOURS OPEN CIRCUIT, DISCHARGE C/6 RATE

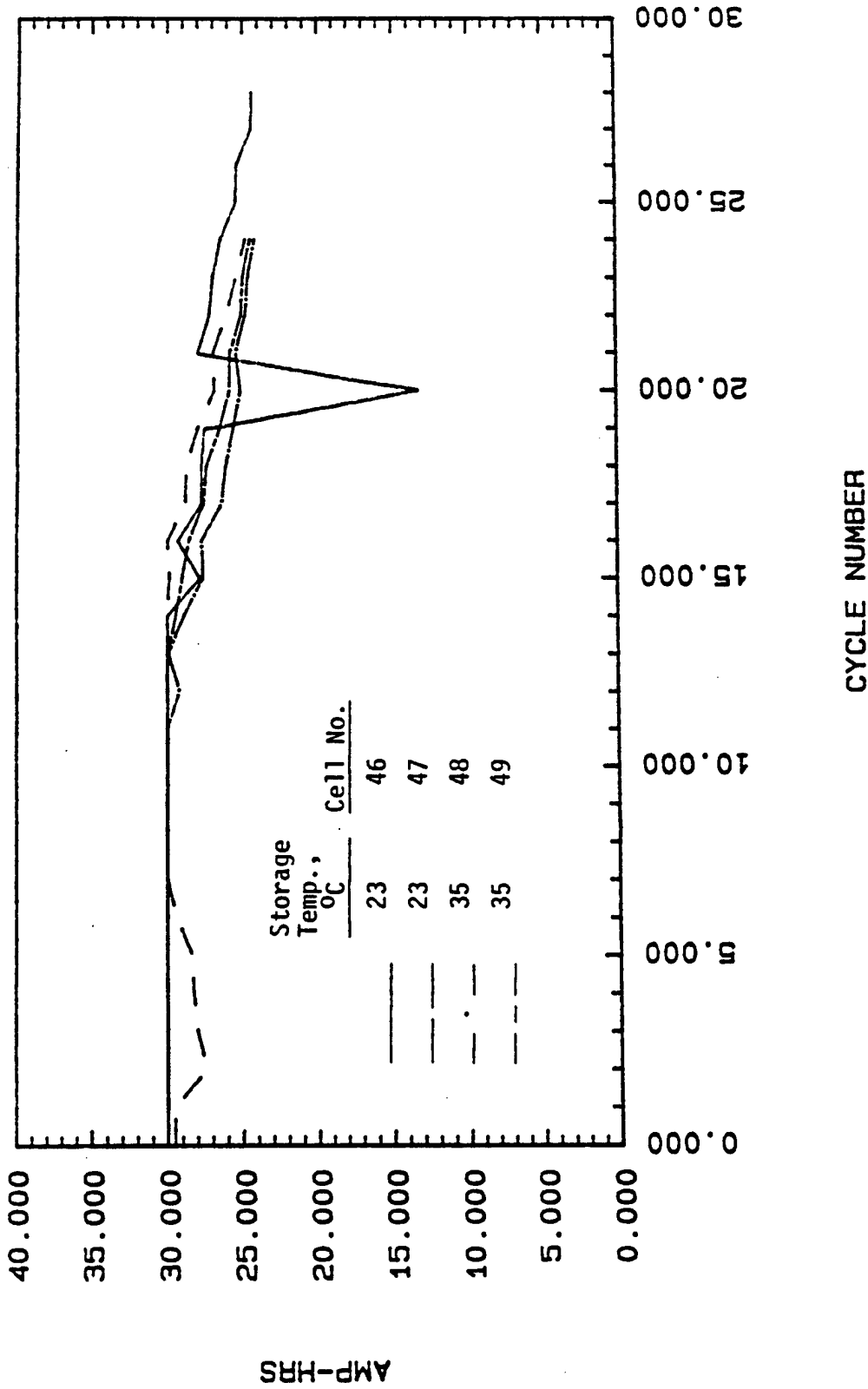


FIGURE 3-8. 30-Ah SILVER OXIDE/ZINC CELLS, DISCHARGE CAPACITY (C/6 RATE, 23°C) V/S. CYCLE NUMBER, UNCYCLED CELLS, FULLY DISCHARGED; STORED THREE MONTHS AT 23°C (CELL NOS. 46 AND 47), AT 35°C (CELL NOS. 48 AND 49)

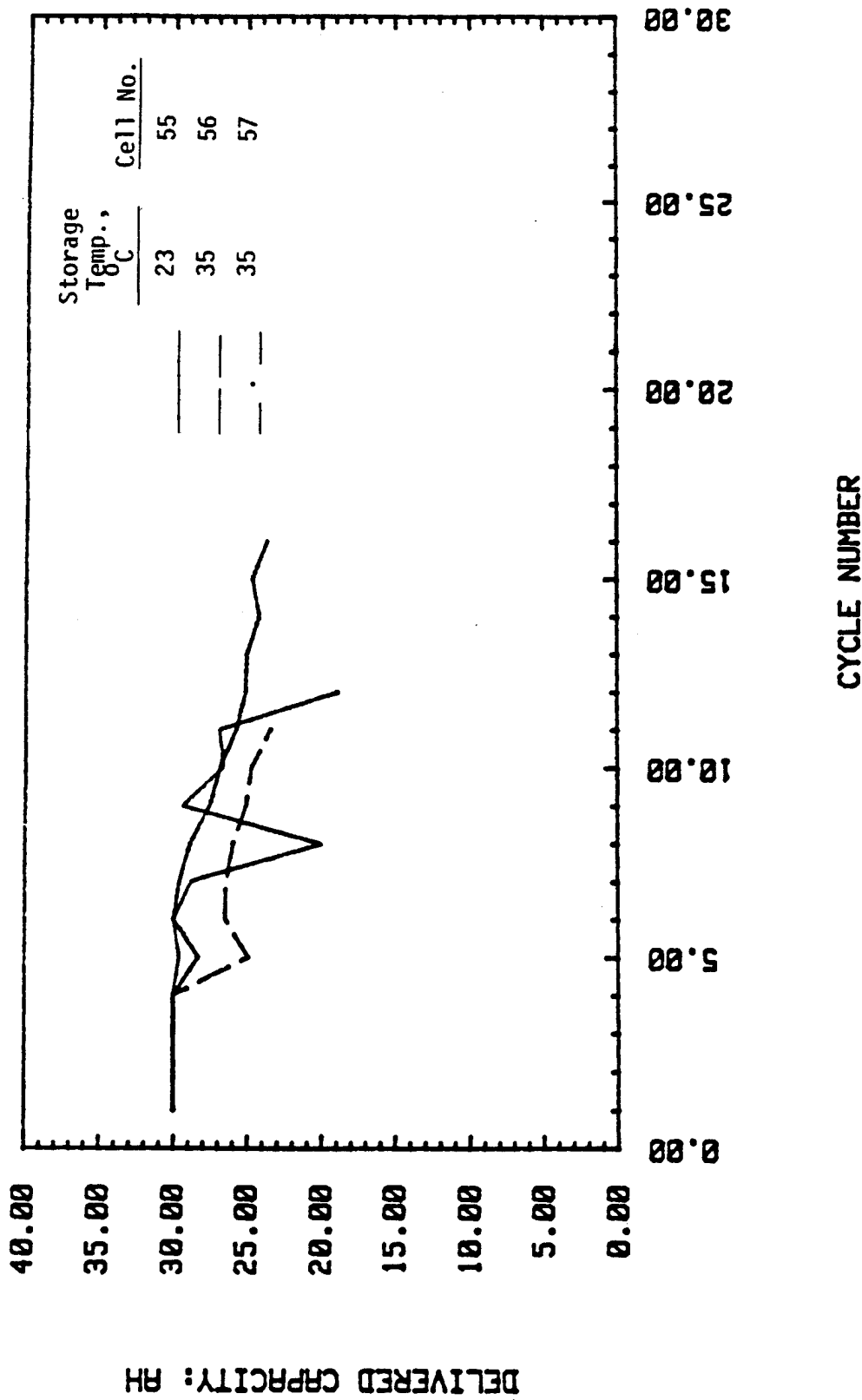


FIGURE 3-9. 30-Ah SILVER OXIDE/ZINC CELLS, DISCHARGE CAPACITY (C/6 RATE, 23°C) VS. CYCLE NUMBER, FULLY DISCHARGED, STORED THREE MONTHS AT 23°C (CELL NO. 55) AT 35°C (CELL NOS. 56 AND 57); PRIOR TO STORAGE, CELLS WERE CHARGED (C/10 RATE) AND DISCHARGED (C/6 RATE) FOUR TIMES

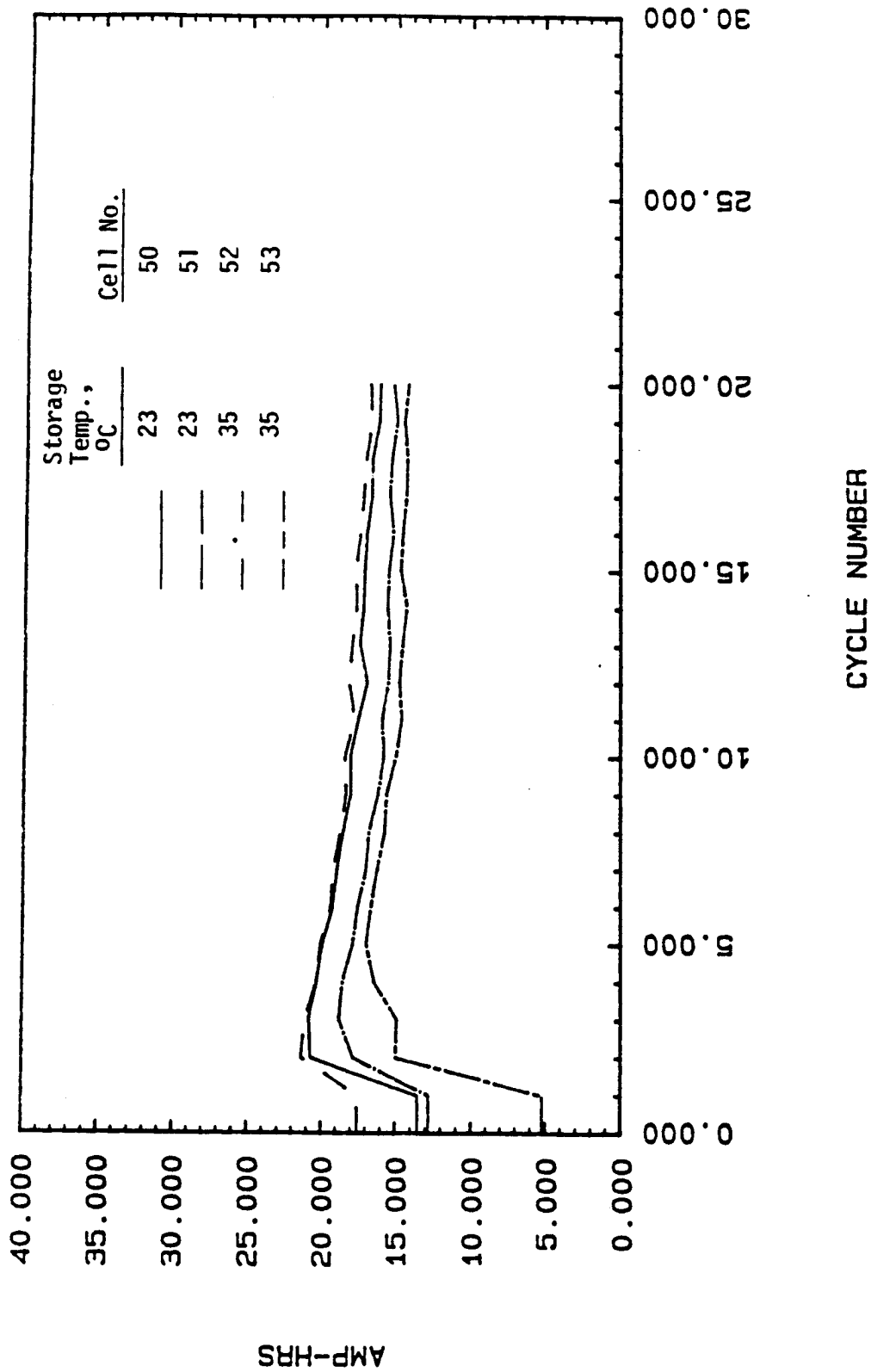


FIGURE 3-10. 30-Ah SILVER OXIDE/ZINC CELLS, DISCHARGE CAPACITY (C/6 RATE, 23°C) V/S. CYCLE NUMBER, AFTER FIRST FULL C/10 RATE CHARGE, STORED THREE MONTHS AT 23°C (CELL NOS. 50 AND 51), AT 35°C (CELL NOS. 52 AND 53)

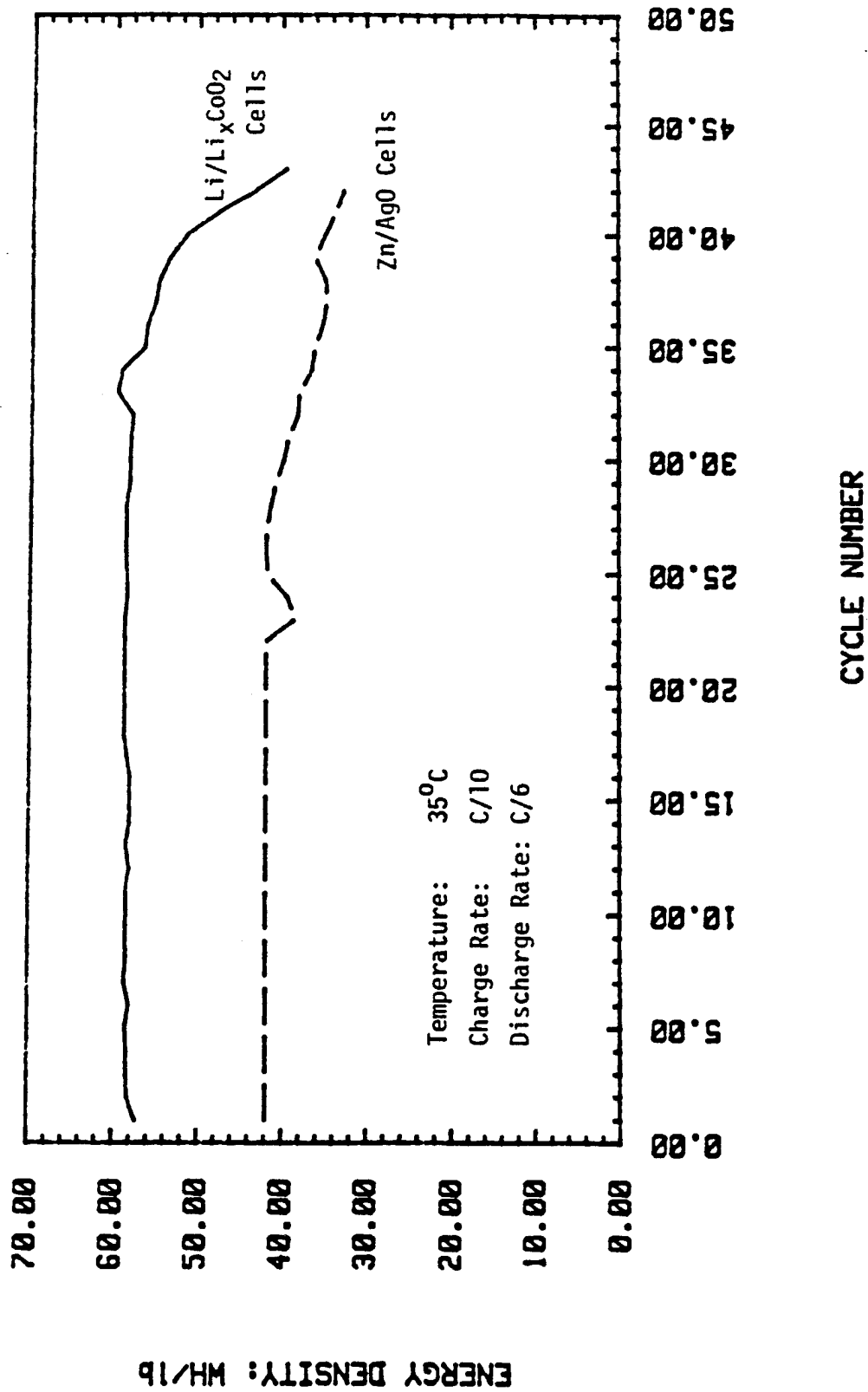


FIGURE 3-11. DATA FOR 30-Ah SILVER OXIDE/ZINC AND 30-Ah LITHIUM/LITHIUM COBALT OXIDE FRESH CELLS; ENERGY DENSITY V/S. CYCLE NUMBER AT 35°C; CYCLING REGIME: CHARGE RATE, C/10, DISCHARGE RATE, C/6

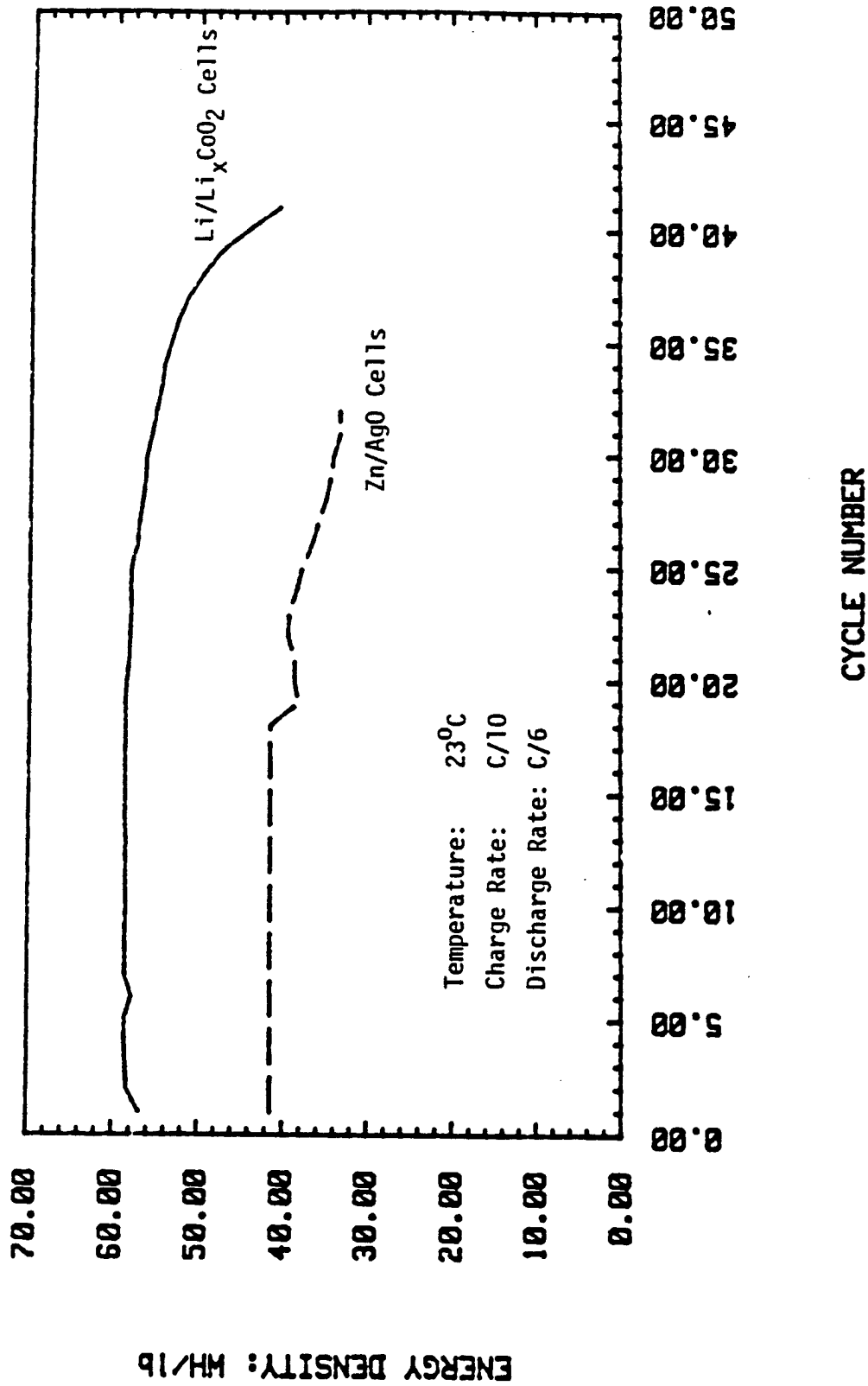


FIGURE 3-12. 30-Ah SILVER OXIDE/ZINC AND 30-Ah LITHIUM/LITHIUM COBALT OXIDE FRESH CELLS; ENERGY DENSITY VS. CYCLE NUMBER AT 23°C; CYCLING REGIME: CHARGE RATE, C/10, DISCHARGE RATE, C/6

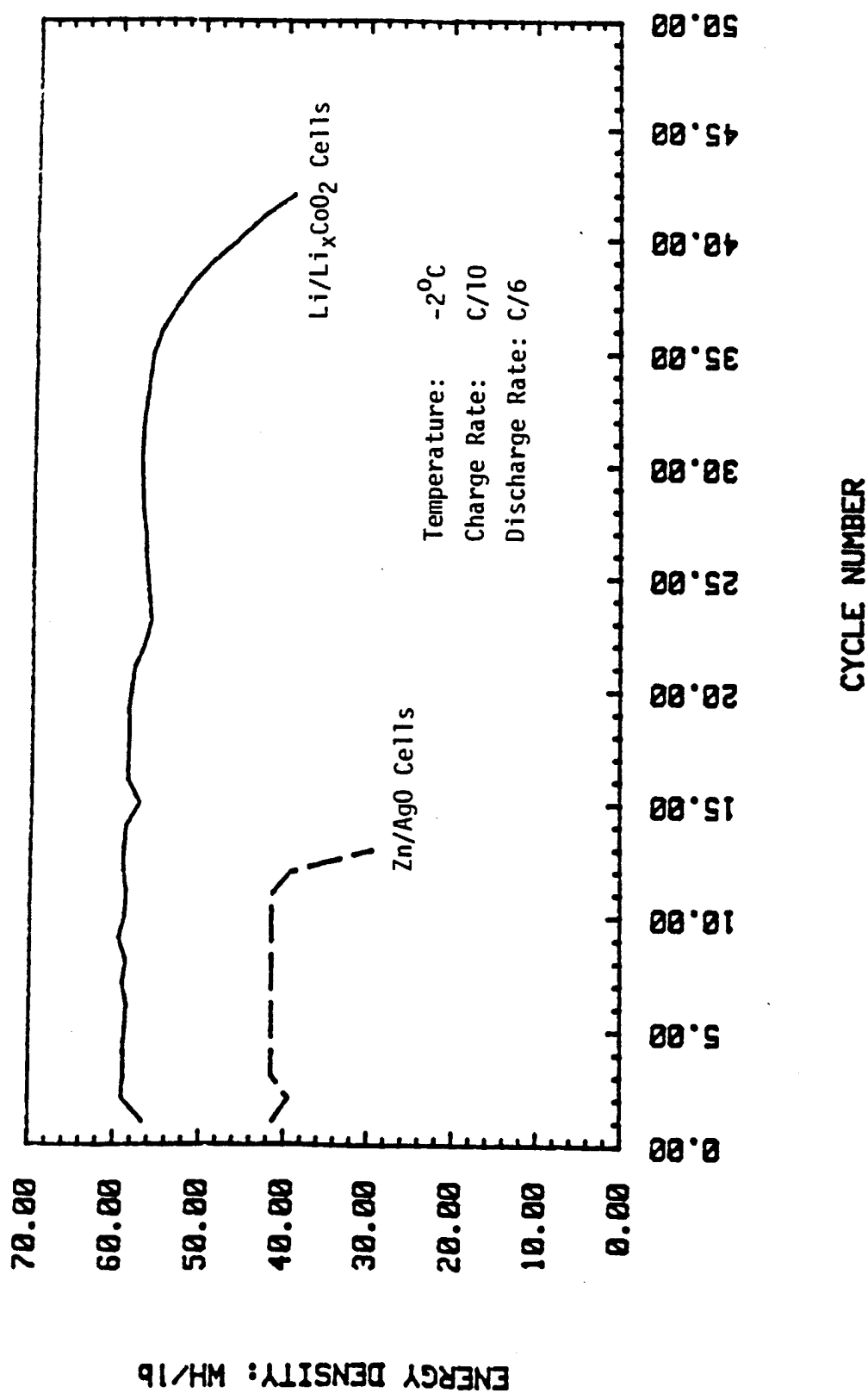


FIGURE 3-13. 30-Ah SILVER OXIDE/ZINC AND 30-Ah LITHIUM/LITHIUM COBALT OXIDE FRESH CELLS; ENERGY DENSITY V/S. CYCLE NUMBER AT 35°C; CYCLING REGIME: CHARGE RATE, C/10, DISCHARGE RATE, C/6

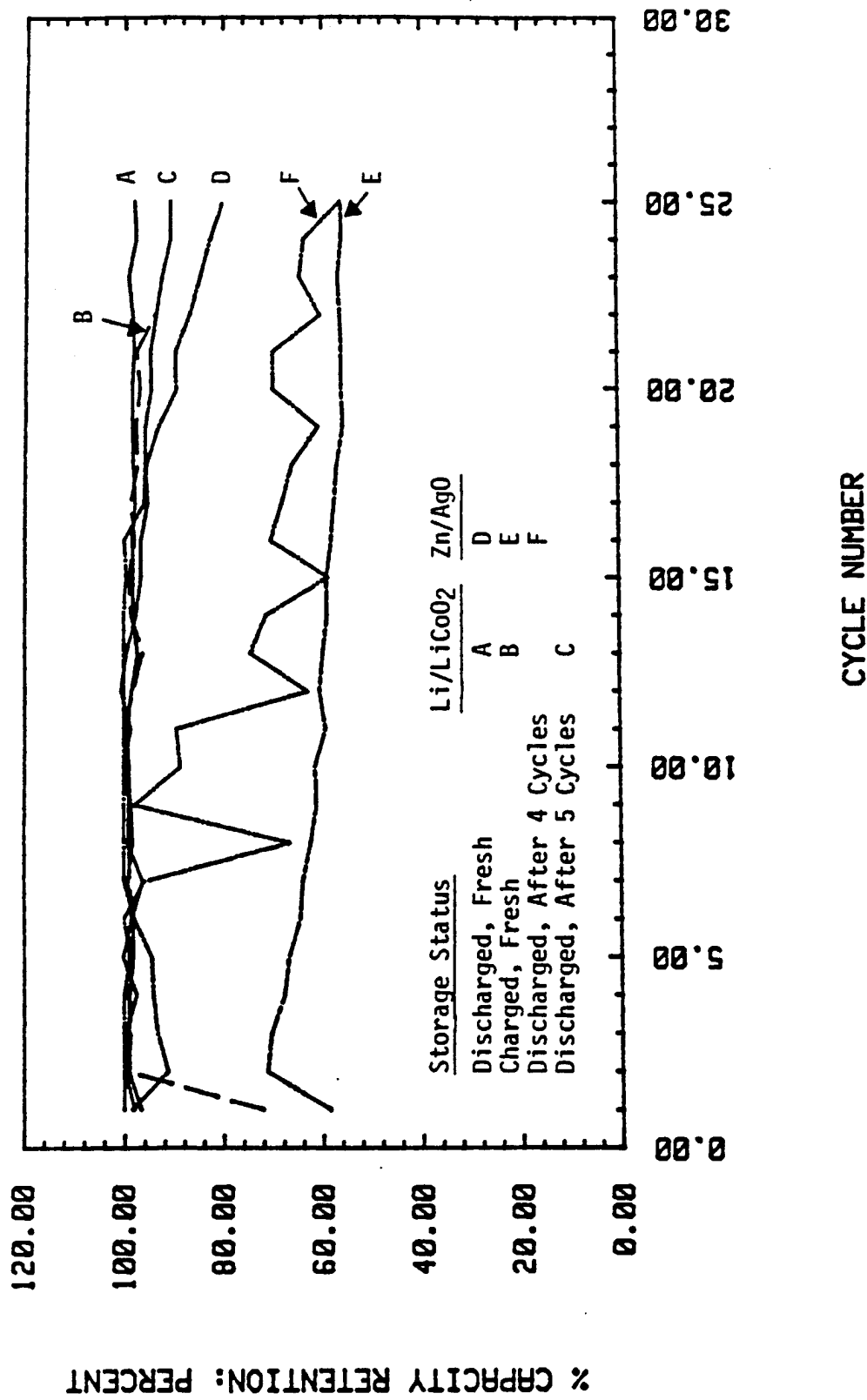


FIGURE 3-14. 30-Ah SILVER OXIDE/ZINC AND 30-Ah LITHIUM/LITHIUM COBALT OXIDE, PERCENT CAPACITY ON CYCLING AFTER STORAGE FOR THREE MONTHS AT 23°C; CURVE A (Li/Li₂CoO₂) AND CURVE D (AgO/Zn) FRESH, DISCHARGED; CURVE B (Li/Li₂CoO₂) AND CURVE E (AgO/Zn), FRESH, CHARGED; CURVE C (Li/Li₂CoO₂), AFTER FIVE CYCLES, DISCHARGED; CURVE F (AgO/Zn), AFTER FOUR CYCLES, DISCHARGED

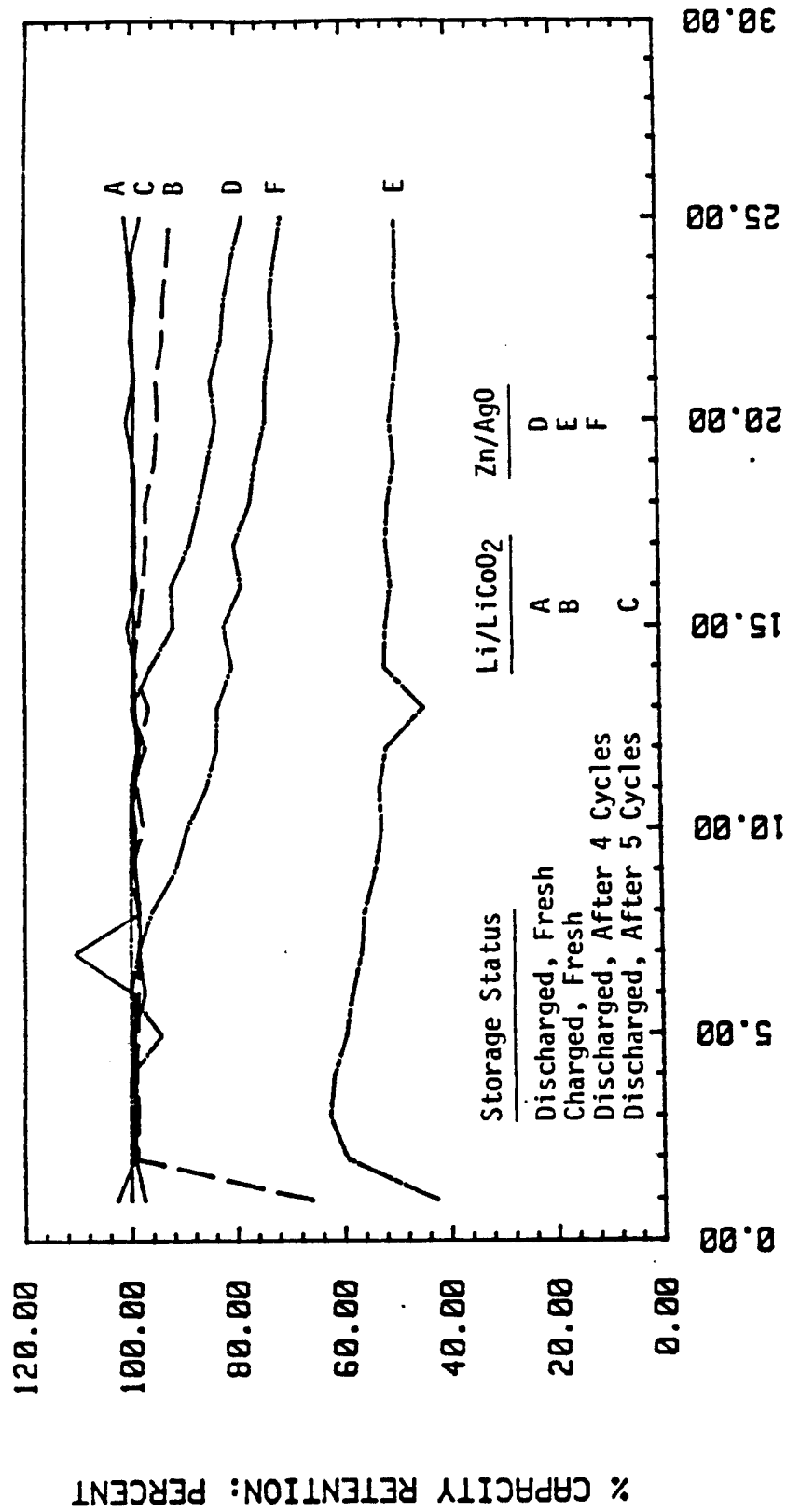


FIGURE 3-15. 30-Ah SILVER OXIDE/ZINC AND 30-Ah LITHIUM/LITHIUM COBALT OXIDE, PERCENT CAPACITY AFTER STORAGE FOR THREE MONTHS AT 35°C; CURVE A (Li/Li_xCoO₂) AND CURVE D (AgO/Zn) FRESH, DISCHARGED; CURVE B (Li/Li_xCoO₂) AND CURVE E (AgO/Zn), FRESH, CHARGED; CURVE C (Li/Li_xCoO₂, AFTER FOUR CYCLES, DISCHARGED, CURVE F (AgO/Zn), AFTER FIVE CYCLES, DISCHARGED

TABLE 3-1. PERFORMANCE SUMMARY OF 30-Ah AgO/Zn CELLS									
Cell Nos.	Cell Condition Before Test	Test Temp., °C	Discharge Rate	Charge Rate	Charge Delay, Hours	Cycles To 24 Ah	Average Capacity, Ah	Mid Voltage, Volts	Average Energy Density, Wh/lb
1 2 3	Fresh	-2	C/6	C/30	100	20 19 23	29.86 29.49 28.67	1.44 1.46 1.44	39.05 39.10 37.49
4 5 6	Fresh	35	C/6	C/30	100	>59 >27 37	29.55 29.71 28.82	1.53 1.52 1.53	40.92 41.03 40.01
7 8 9	Fresh	23	C/6	C/30	100	50 >34 48	28.82 27.18 29.20	1.51 1.51 1.51	39.51 37.14 39.95
10 11 12	Fresh	-2	C/6	C/10	100	11 11 13	28.96 28.93 28.29	1.46 1.47 1.48	38.41 38.57 37.92
13 14 15	Fresh	35	C/6	C/10	100	29 26 35	29.01 29.35 28.76	1.54 1.53 1.53	40.51 40.74 40.00
16 17 18	Fresh	23	C/6	C/10	100	33 36 35	28.74 28.64 28.18	1.52 1.53 1.51	39.64 39.70 38.72
19 20 21	2 months storage @ R/T in fully discharged state	23	C/6	C/10	—	23 — 24	29.43 Overcharged 29.21	1.53 — 1.53	40.80 — 40.53
22 23 24	Fresh	35	C/6	C/10	—	41 40 42	28.47 28.83 29.26	1.54 1.53 1.53	39.69 40.16 40.70
25 26 27	3 months storage @ R/T in fully charged state after 11th charge	35	C/6	C/10	—	24 15 24	28.72 30.00 28.65	1.50 1.52 1.52	39.22 41.46 39.60
28	Abuse Test: Overdischarge								
31	Abuse Test: Overcharge								
35, 36	Abuse Test: Short								
46 47	3 months storage @ R/T in fully discharged state	23	C/6	C/10	—	28 24	27.88 28.58	1.52 1.52	38.54 39.49
48 49	3 months storage @ 35°C in fully discharged state	23	C/6	C/10	—	24 24	28.14 28.50	1.53 1.53	39.17 39.68

TABLE 3-1. PERFORMANCE SUMMARY OF 30-Ah AgO/Zn CELLS (Con't.)									
Cell Nos.	Cell Condition Before Test	Test Temp., °C	Discharge Rate	Charge Rate	Charge Delay, Hours	Cycles To 24 Ah	Average Capacity, Ah	Mid Voltage, Volts	Average Energy Density, Wh/lb
50 51	3 months storage @ R/T in fully charged state	23	C/6	C/10	---	0 0	--- ---	--- ---	--- ---
52 53	3 months storage @ 35°C in fully charged state	23	C/6	C/10	---	0 0	--- ---	--- ---	--- ---
54 55	3 months storage @ R/T in fully discharged state after 4 cycles	23	C/6	C/10	---	--- 11	Overcharged 28.28	--- 1.54	--- 39.47
56 57	3 months storage @ 35°C in fully discharged state after 4 cycles	23	C/6	C/10	---	10 15	27.34 27.71	1.54 1.54	38.11 38.70
58 59	Fresh	-2	C/6	C/10	---	12 12	29.49 29.73	1.51 1.51	40.36 40.65
60	Fresh	23	C/6	C/10	---	32	28.47	1.52	39.31

CHAPTER 4

CONCLUSIONS AND FUTURE WORK

The 30-Ah silver oxide/zinc cells evaluated in this study could provide 50-60 cycles to 80 per cent of nominal capacity when discharged at the C/6 rate and recharged at the C/30 rate, at room temperature and at 35°C. Cycling at -2°C, however, delivered only about 20 cycles. When the C/10 charging rate was used, reduced cycle life resulted. Charging at that rate (and discharging at the six-hour rate), only 30-40 cycles were obtained at room temperature and at 35°C. Only about a dozen cycles were obtained at -2°C.

Thirty-ampere-hour lithium/cobalt oxide cells under the same conditions delivered 40 cycles regardless of temperature. Furthermore, while the AgO/Zn provided only 40 Wh/kg, the Li/Li_xCoO₂ gave nearly 60 Wh/kg. In contrast to AgO/Zn, which can only be stored in the discharged state, Li/Li_xCoO₂ proved capable of charged or discharged storage. That, and the ability to be rapidly charged,² are advantages to field operation.

The lithium system demonstrated sufficient performance to support further development as a replacement for the present AgO/Zn power source for underwater vehicles. As the system improves through further development and engineering to larger sizes, it will again be compared to comparably-sized silver cells.

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APPENDIX A

RAW DATA OF 30-Ah Zn/AgO Cells Tested

PERFORMANCE SUMMARY OF 30 AH Zn/AgO CELLS

01/29/92
File: AGOZNS1

File: AGCZNS1									
Cell No.	Cell Condition Before Test	Test Temp, °C	Discharge Rate	Charge Rate	Charge Delay, Hours	Cycles To 24 AH	Average Capacity, AH	Mid Voltage, Volts	Average Energy Density, WH/lb
1	Fresh	-2	C/6	C/30	100	20	29.88	1.44	39.05
2						19	29.49	1.46	39.10
3						23	28.67	1.44	37.49
4	Fresh	35	C/6	C/30	100	>59	29.55	1.53	40.92
5						>27	29.71	1.52	41.03
6						37	28.82	1.53	40.01
7	Fresh	23	C/6	C/30	100	50	28.82	1.51	39.51
8						>27-34	29.58	1.51	40.42
9						48	29.20	1.51	39.95
10	Fresh	-2	C/6	C/10	100	11	28.98	1.46	38.41
11						11	28.93	1.47	38.57
12						13	28.29	1.48	37.92
13	Fresh	35	C/6	C/10	100	29	29.01	1.54	40.51
14						26	29.35	1.53	40.74
15						35	28.76	1.53	40.00
16	Fresh	23	C/6	C/10	100	33	29.15	1.52	40.21
17						36	29.47	1.53	40.86
18						35	29.04	1.51	39.90
19	2 months storage @ R/T in fully discharged state	23	C/6	C/10	----	23	29.43	1.53	40.80
20						----	Overcharged	----	----
21						24	29.21	1.53	40.53
22	Fresh	35	C/6	C/10	----	41	28.47	1.54	39.69
23						40	28.83	1.53	40.16
24						42	29.26	1.53	40.70
25	3 month storage @ R/T in fully charged state after 11 th charge	35	C/6	C/10	----	24	28.72	1.50	39.22
26						15	30.00	1.52	41.46
27						24	28.65	1.52	39.60
28	Abuse Test: Overdischarge								
31	Abuse Test: Overcharge								
35	Abuse Test: Short								
36									
46	3 month storage @ R/T in fully discharged state	23	C/6	C/10	----	26	27.88	1.52	38.54
47						24	28.58	1.52	39.49
48	3 month storage @ 35 °C in fully discharged state	23	C/6	C/10	----	24	28.14	1.53	39.17
49						24	28.50	1.53	39.68
50	3 month storage @ R/T in fully charged state	23	C/6	C/10	----	0	----	----	----
51						0	----	----	----
52	3 month storage @ 35 °C in fully charged state	23	C/6	C/10	----	0	----	----	----
53						0	----	----	----
54	3 month storage @ R/T in fully discharged state after 4 cycles	23	C/6	C/10	----	----	Overcharged	----	----
55						11	28.28	1.54	39.47
56	3 month storage @ 35 °C in fully discharged state after 4 cycles	23	C/6	C/10	----	10	27.34	1.54	38.11
57						15	27.71	1.54	38.70
58	Fresh	-2	C/6	C/10	----	12	29.49	1.51	40.36
59						12	29.73	1.51	40.65
60	Fresh	23	C/6	C/10	----	32	28.47	1.52	39.31

CELL NO: Zn/AgO #1

TEST NAME: ZN01CL1

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.000	42.402	41	18.093	18.229	81		
2	30.001	30.524	42	18.401	18.495	82		
3	30.000	30.315	43	19.146	18.938	83		
4	30.000	28.618	44	17.901	19.643	84		
5	30.001	29.945	45	17.112	17.952	85		
6	30.001	29.938	46	16.988	17.495	86		
7	30.000	29.211	47	16.997	17.410	87		
8	30.000	30.050	48	16.839	17.525	88		
9	30.001	29.910	49	16.502	17.018	89		
10	30.001	30.135	50	16.340	16.761	90		
11	30.000	29.264	51	16.363	16.625	91		
12	29.217	29.558	52	16.070	16.604	92		
13	28.062	28.310	53	16.035	16.466	93		
14	30.001	26.796	54	15.740	16.202	94		
15	30.001	27.922	55	15.695	15.979	95		
16	30.001	28.743	56	14.900	15.862	96		
17	30.000	35.280	57	15.235	15.554	97		
18	30.000	25.572	58		12.000	98		
19	30.000	28.581	59	Terminated @ 58C		99		
20	30.001	31.714	60			100		
21	23.892	26.972	61			101		
22	19.703	23.179	62			102		
23	25.300	19.983	63			103		
24	18.694	6.984 *	64			104		
25	27.502	36.784	65			105		
26	23.690	26.680	66			106		
27	26.241	22.255	67			107		
28	28.641	28.188	68			108		
29	27.537	28.710	69			109		
30	26.710	27.157	70			110		
31	29.115	26.912	71			111		
32	30.000	29.062	72			112		
33	27.048	28.702	73			113		
34	25.332	28.202	74			114		
35	29.659	25.511	75			115		
36	22.204	33.144	76			116		
37	17.338	17.355	77			117		
38	17.481	17.808	78			118		
39	17.248	17.263	79			119		
40	17.745	17.732	80			120		

Ave. cap. 1-20 cycles: AH

29.864 30.139

C/30 CHARGE RATE WITH 100 HRS POST CHARGE DELAY, TEMP = - 2 °C

* Station malfunction, final voltage was 2.168 V

CELL NO: Zn/AgO #2

TEST NAME: ZN02CL1

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.001	43.845	41			81		
2	30.000	29.467	42			82		
3	30.000	30.203	43			83		
4	30.001	28.628	44			84		
5	30.000	30.573	45			85		
6	30.001	29.979	46			86		
7	30.001	29.470	47			87		
8	30.001	30.039	48			88		
9	30.001	29.881	49			89		
10	30.000	30.399	50			90		
11	30.001	29.499	51			91		
12	30.001	29.755	52			92		
13	28.740	29.338	53			93		
14	30.001	27.716	54			94		
15	26.130	26.932	55			95		
16	27.861	27.961	56			96		
17	30.000	28.844	57			97		
18	27.592	33.778	58			98		
19	30.000	25.768	59			99		
20	23.705	30.495	60			100		
21	25.716	22.750	61			101		
22	23.760	25.343	62			102		
23	23.515	23.219	63			103		
24	23.932	23.345	64			104		
25	22.492	23.467	65			105		
26	18.889	22.434	66			106		
27	30.000	18.733	67			107		
28	30.000	34.136	68			108		
29	23.204	23.839	69			109		
30	29.189	23.862	70			110		
31		*	71			111		
32			72			112		
33			73			113		
34			74			114		
35			75			115		
36			76			116		
37			77			117		
38			78			118		
39			79			119		
40			80			120		

Ave. cap. 1-19 cycles: AH

29.491 30.109

C/30 CHARGE RATE WITH 100 HRS POST CHARGE DELAY, TEMP = - 2 °C

* Suspended @ 31C to free the channel for other testing

CELL NO: Zn/AgO #3

TEST NAME: ZN03CL2

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.000	20.355	41	17.290	17.709	81		
2	30.000	30.118	42	17.733	17.273	82		
3	30.000	30.208	43	17.634	17.651	83		
4	30.000	27.820	44	18.195	17.890	84		
5	30.001	29.302	45	18.149	18.343	85		
6	30.001	29.218	46	19.639	17.471	86		
7	30.001	28.165	47	17.490	19.735	87		
8	30.000	29.002	48	17.587	17.839	88		
9	30.001	28.733	49	17.451	17.658	89		
10	30.001	29.252	50	17.259	17.637	90		
11	30.001	28.720	51	17.370	17.460	91		
12	27.789	29.695	52	17.290	17.593	92		
13	27.448	25.619	53	17.142	17.508	93		
14	30.000	26.741	54	17.060	17.393	94		
15	28.196	33.460	55	16.898	17.328	95		
16	27.562	26.543	56	16.689	17.142	96		
17	30.000	26.246	57	16.130	16.909	97		
18	25.917	30.679	58	16.178	16.467	98		
19	30.000	23.463	59	11.087	16.390	99		
20	23.291	25.890	60	15.611	17.802	100		
21	24.761	23.762	61		16.059	101		
22	29.642	21.712	62	Terminated @ 61R		102		
23	24.813	26.096	63			103		
24	21.305	25.543	64			104		
25	18.875	21.360	65			105		
26	30.000	16.674	66			106		
27	27.497	29.602	67			107		
28	24.128	26.054	68			108		
29	24.678	23.632	69			109		
30	25.388	23.275	70			110		
31	22.778	24.750	71			111		
32	26.464	22.605	72			112		
33	26.138	24.672	73			113		
34	24.583	24.963	74			114		
35	21.707	24.368	75			115		
36	24.464	20.638	76			116		
37	29.431	25.025	77			117		
38	30.001	30.168	78			118		
39	21.062	30.987	79			119		
40	17.780	19.228	80			120		

Ave. cap. 1-23 cycles: AH

28.670

27.426

C/30 CHARGE RATE WITH 100 HRS POST CHARGE DELAY, TEMP = - 2 °C

CELL NO.: Zn/AgO #4

TEST NAME: ZN04CL1

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.000	50.000	41	30.000	30.050	81		
2	30.000	33.400	42	30.001	31.395	82		
3	30.000	30.314	43	30.001	30.123	83		
4	30.000	29.404	44	30.001	30.005	84		
5	30.001	29.658	45	30.000	30.202	85		
6	30.000	30.231	46	29.752	30.096	86		
7	30.000	30.320	47	27.660	28.188	87		
8	30.000	30.551	48	29.827	32.078 **	88		
9	30.000	30.157	49	28.983	29.125	89		
10	30.000	29.973	50	30.000	30.441	90		
11	30.000	29.768	51	28.715	30.170	91		
12	30.000	29.646	52	29.385	30.338	92		
13	30.000	29.313	53	28.928	29.753	93		
14	30.000	29.330	54	28.203	28.643	94		
15	30.000	31.569	55	27.576	28.929	95		
16	30.001	30.503	56	26.965	27.561	96		
17	30.001	29.322	57	26.152	26.304	97		
18	30.000	30.376	58	25.837	26.701	98		
19	30.000	30.044	59	25.646	26.029	99		
20	30.000	29.662	60		26.996	100		
21	30.000	30.034	61	Terminated @ 60R		101		
22	30.001	29.563	62			102		
23	30.000	29.880	63			103		
24	30.000	27.484	64			104		
25	30.000	31.047	65			105		
26	30.000	30.046	66			106		
27	30.001	30.572	67			107		
28	30.001	30.713	68			108		
29	30.000	23.339	69			109		
30	30.001	33.403	70			110		
31	30.000	32.016	71			111		
32	30.000	31.227	72			112		
33	30.000	31.552	73			113		
34	30.001	31.071	74			114		
35	30.000	30.175	75			115		
36	30.000	29.446	76			116		
37	30.000	29.576	77			117		
38	30.001	29.471	78			118		
39	30.001	32.332 *	79			119		
40	30.001	30.550	80			120		

Ave. cap. 1-59 cycles: AH

29.553 30.223

C/30 CHARGE RATE WITH 100 HRS POST CHARGE DELAY, TEMP = 35 °C

* Noisy voltage on OCV (39R)

** Noisy voltage on 48C

CELL NO: Zn/AqO #5 TEST NAME: ZN05CL1

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.000	48.181	41			81		
2	30.000	31.730	42			82		
3	30.000	29.731	43			83		
4	30.000	29.893	44			84		
5	30.000	29.197	45			85		
6	30.000	29.673	46			86		
7	30.000	29.751	47			87		
8	30.000	29.851	48			88		
9	30.000	29.381	49			89		
10	30.000	30.594	50			90		
11	30.000	28.947	51			91		
12	30.000	29.952	52			92		
13	30.000	29.428	53			93		
14	22.104	7.841 *	54			94		
15	30.000	34.462	55			95		
16	30.000	36.489	56			96		
17	30.000	29.742	57			97		
18	30.000	29.344	58			98		
19	30.000	28.063	59			99		
20	30.000	29.223	60			100		
21	30.000	28.893	61			101		
22	30.000	29.300	62			102		
23	30.000	28.730	63			103		
24	30.000	28.660	64			104		
25	30.000	29.375	65			105		
26	30.000	28.234	66			106		
27	30.000	28.258	67			107		
28	**	29.394	68			108		
29			69			109		
30			70			110		
31			71			111		
32			72			112		
33			73			113		
34			74			114		
35			75			115		
36			76			116		
37			77			117		
38			78			118		
39			79			119		
40			80			120		

Ave. cap. 1-27 cycles: AH

29.708 29.738

C/30 CHARGE RATE WITH 100 HRS POST CHARGE DELAY, TEMP = 35 °C

* Station malfunction

** Suspended @ 28D to free the channel for other testing

CELL NO: Zn/AgO #6

TEST NAME: ZN06CL1

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.000	47.373	41	21.710	22.458	81		
2	30.001	31.618	42	21.203	21.892	82		
3	30.001	29.964	43	20.657	21.359	83		
4	30.000	29.067	44	20.129	20.848	84		
5	30.001	30.022	45	19.728	20.418	85		
6	30.000	30.231	46	19.292	19.998	86		
7	30.000	30.463	47	18.917	19.635	87		
8	30.000	30.608	48	18.441	19.157	88		
9	30.000	30.061	49	18.064	18.149	89		
10	30.000	29.895	50	17.641	18.331	90		
11	30.001	29.634	51	17.219	17.917	91		
12	30.001	29.701	52	16.832	17.474	92		
13	30.001	29.461	53	16.390	16.308	93		
14	30.003	27.254	54	16.106	16.778	94		
15	30.001	30.186	55	15.599	16.440	95		
16	30.000	29.341	56	15.331	15.886	96		
17	30.001	28.681	57	14.038	15.568	97		
18	30.001	29.562	58	14.350	14.380	98		
19	30.000	29.381	59		14.850	99		
20	30.000	29.264	60	Terminated @ 59R		100		
21	30.000	29.491	61			101		
22	30.001	27.821	62			102		
23	30.000	29.304	63			103		
24	30.000	29.088	64			104		
25	30.000	30.418	65			105		
26	30.000	29.431	66			106		
27	29.333	28.654	67			107		
28	26.930	27.565	68			108		
29	28.686	28.106	69			109		
30	28.548	29.092	70			110		
31	27.652	28.123	71			111		
32	27.389	27.426	72			112		
33	26.708	27.226	73			113		
34	26.029	26.702	74			114		
35	15.735	15.877 *	75			115		
36	24.833	25.606	76			116		
37	24.490	25.193	77			117		
38	23.221	23.910	78			118		
39	22.876	22.990	79			119		
40	22.388	23.097	80			120		

Ave. cap. 1-37 cycles: AH
28.820 29.105

C/30 CHARGE RATE WITH 100 HRS POST CHARGE DELAY, TEMP = 35 °C

* Cell was suspended after 15.9 hours charging V = 1.906v. The voltage was then up to 2.14 V. Back on test on 35R.

CELL NO: Zn/AgO #7

TEST NAME: ZN07CL2

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.001	48.664	41	27.735	28.881	81		
2	30.001	33.936	42	27.158	27.617	82		
3	30.000	30.439	43	27.118	27.409	83		
4	30.001	29.994	44	27.215	27.406	84		
5	30.000	29.345	45	26.286	26.989	85		
6	30.001	29.899	46	26.235	26.611 *	86		
7	30.001	30.506	47	25.388	26.048 **	87		
8	30.001	30.207	48	25.206	25.505	88		
9	30.000	29.101	49	24.505	25.365	89		
10	30.000	30.854	50	24.406	24.993	90		
11	30.000	29.096	51	23.712	24.268	91		
12	30.001	29.768	52	23.067	24.008	92		
13	30.001	29.759	53	22.835	23.208	93		
14	30.001	29.778	54	22.126	22.823	94		
15	30.000	28.660	55	21.456	21.922	95		
16	30.001	29.832	56	20.877	21.737	96		
17	30.001	28.683	57	20.405	21.086	97		
18	30.000	29.610	58	20.211	20.540	98		
19	30.000	28.961	59	19.502	19.602	99		
20	30.000	27.400	60	19.399	19.747	100		
21	30.001	29.852	61	18.626	19.410	101		
22	30.000	30.466	62	18.104	18.658	102		
23	30.001	28.871	63	17.382	18.276	103		
24	30.000	28.502	64	16.593	17.464	104		
25	30.001	29.640	65		16.587	105		
26	30.001	31.157	66	Terminated @ 65R		106		
27	30.000	29.529	67			107		
28	30.000	28.505	68			108		
29	29.184	28.286	69			109		
30	27.485	27.488	70			110		
31	28.099	26.143	71			111		
32	28.025	27.357	72			112		
33	27.883	27.577	73			113		
34	29.124	27.815	74			114		
35	27.963	28.730	75			115		
36	28.309	26.551	76			116		
37	28.518	29.527	77			117		
38	27.939	27.574	78			118		
39	28.603	29.129	79			119		
40	28.579	30.108	80			120		

Ave. cap. 1-50 cycles

28.820 29.082

C/30 CHARGE RATE WITH 100 HOURS POST DELAY, TEMP = 22°C

* Noisy voltage on OCV

** Noisy voltage on charging

CELL NO: Zn/AgO #8

TEST NAME: ZN08CL2

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.001	38.265	41			81		
-2	30.001	31.004	42			82		
3	30.000	30.515	43			83		
4	30.000	29.514	44			84		
5	30.000	30.401	45			85		
6	30.000	29.888	46			86		
7	30.000	30.431	47			87		
8	30.001	30.420	48			88		
9	30.000	28.904	49			89		
10	30.001	30.948	50			90		
11	30.000	28.967	51			91		
12	30.000	29.525	52			92		
13	30.000	29.208	53			93		
14	30.001	29.500	54			94		
15	30.000	28.131	55			95		
16	30.001	29.642	56			96		
17	30.001	28.274	57			97		
18	30.000	28.424	58			98		
19	30.001	28.991	59			99		
20	30.000	28.812	60			100		
21	30.001	28.648	61			101		
22	30.000	29.134	62			102		
23	30.000	27.983	63			103		
24	30.000	28.300	64			104		
25	30.000	29.164	65			105		
26	30.000	29.921	66			106		
27	30.000	28.636	67			107		
28	30.000	27.836	68			108		
29	29.416	27.799	69			109		
30	26.761	27.431	70			110		
31	27.613	26.394	71			111		
32	27.042	27.299	72			112		
33	27.096	26.833	73			113		
34	27.698	26.499	74			114		
35		*	75			115		
36			76			116		
37			77			117		
38			78			118		
39			79			119		
40			80			120		

Ave. cap. 1-34 cycles: AH

29.577 29.166

C/30 CHARGE RATE WITH 100 HRS POST CHARGE DELAY, TEMP = 23 °C

• Suspended @ 35 C to free the channel for other testing

CELL NO: Zn/AgO #9

TEST NAME: ZN09CL3

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.000	36.169	41	27.305	29.378	81		
2	30.000	30.908	42	26.812	27.261	82		
3	30.001	29.968	43	26.852	27.431	83		
4	30.000	29.071	44	26.820	26.788	84		
5	30.001	31.660	45	25.912	26.761	85		
6	30.000	29.877	46	25.255	26.098	86		
7	30.000	30.373	47	25.410	25.749	87		
8	30.000	30.291	48	24.126	25.211	88		
9	30.000	29.505	49	23.922	24.749	89		
10	30.001	30.793	50	23.760	24.372	90		
11	30.000	29.359	51	23.012	23.736	91		
12	30.001	30.322	52	22.594	23.360	92		
13	30.000	29.988	53	22.054	22.686	93		
14	30.001	29.693	54	21.395	22.183	94		
15	30.000	29.553	55	20.726	21.440	95		
16	30.000	30.303	56	20.176	20.916	96		
17	30.001	29.984	57	19.674	20.275	97		
18	30.001	29.838	58	19.454	19.717	98		
19	30.000	30.393	59	18.862	19.092	99		
20	30.000	28.769	60	18.593	19.008	100		
21	30.000	31.738	61	18.181	18.702	101		
22	30.000	29.596	62	17.720	18.185	102		
23	30.000	30.368	63	10.423	17.835	103		
24	30.000	28.669	64	16.999	17.919	104		
25	30.000	31.423	65		17.079	105		
26	30.002	29.578	66	Terminated @ 65R		106		
27	30.001	29.889	67			107		
28	30.001	30.073	68			108		
29	29.741	28.930	69			109		
30	28.868	29.328	70			110		
31	29.751	28.411	71			111		
32	29.654	29.183	72			112		
33	29.706	29.970	73			113		
34	30.000	30.512	74			114		
35	30.000	30.326	75			115		
36	29.264	28.746	76			116		
37	29.526	30.320	77			117		
38	29.143	29.955	78			118		
39	28.580	29.312	79			119		
40	28.721	29.055	80			120		

Ave. cap. 1-48 cycles: AH

29.197 29.518

C/30 CHARGE RATE WITH 100 HRS POST CHARGE DELAY, TEMP = 23 °C

CELL NO: Zn/AgO #10

TEST NAME: ZN10CL1, ZN10CL1A

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	29.390	23.431	41			81		
2	29.996	30.439	42			82		
3	30.000	29.892	43			83		
4	30.001	32.568	44			84		
5	29.947	30.741	45			85		
6	30.001	30.474	46			86		
7	29.151	29.503	47			87		
8	28.020	29.201	48			88		
9	27.615	27.933	49			89		
10	27.462	27.235	50			90		
11	26.922	27.712	51			91		
12	23.603	25.933	52			92		
13	23.982	23.687	53			93		
14	22.524	24.427	54			94		
15	21.557	22.275	55			95		
16	25.425	21.568	56			96		
17	22.354	27.246	57			97		
18	30.320	21.589	58			98		
19	21.643	19.472	59			99		
20	30.001	22.053	60			100		
21	23.444	34.079	61			101		
22	20.890	21.462	62			102		
23	23.367	20.283	63			103		
24	17.400	21.617	64			104		
25	18.495	17.451	65			105		
26	17.074	18.563	66			106		
27	17.791	17.768	67			107		
28	17.341	17.592	68			108		
29	19.533	17.494	69			109		
30	18.119	19.774	70			110		
31	30.001 **	21.996 *	71			111		
32	30.000 **	34.509 **	72			112		
33	27.312 **	24.681 **	73			113		
34	28.048 **	29.612 **	74			114		
35		25.918 **	75			115		
36	Terminated @ 35R		76			116		
37			77			117		
38			78			118		
39			79			119		
40			80			120		

Ave. cap. 1-11 cycles: AH

28.955 29.012

C/10 CHARGE RATE WITH 100 HRS POST CHARGE DELAY, TEMP = -2 °C

*Data file corrupted on 31 R. Started new file (ZN10CL1A) on 1 st cycle.

**Room temperature

CELL NO: Zn/AqO #11

TEST NAME: ZN11CL1

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.000	31.575	41	20.534	23.916	81		
2	30.001	32.688	42	21.516	19.160	82		
3	30.000	30.766	43	20.953	21.890	83		
4	30.001	32.592	44	20.620	20.965	84		
5	30.001	28.142	45	24.660	20.395	85		
6	30.001	29.097	46	24.779	26.484	86		
7	29.357	29.796	47	23.658	24.595	87		
8	28.091	28.748	48	17.315	22.602	88		
9	27.527	27.836	49	14.581	13.060	89		
10	27.613	27.183	50	14.075	14.453	90		
11	25.683	27.647	51		13.859	91		
12	23.817	24.867	52	Terminated @ 51R		92		
13	23.918	23.428	53			93		
14	22.023	24.094	54			94		
15	21.350	21.857	55			95		
16	25.263	21.245	56			96		
17	21.763	26.694	57			97		
18	19.557	21.199	58			98		
19	21.307	18.923	59			99		
20	30.000	21.591	60			100		
21	22.637	33.524	61			101		
22	20.218	21.422	62			102		
23	22.693	19.831	63			103		
24	16.816	20.856	64			104		
25	18.075	16.858	65			105		
26	16.906	17.914	66			106		
27	17.342	17.518	67			107		
28	16.684	16.902	68			108		
29	19.228	16.950	69			109		
30	17.385	19.406	70			110		
31	14.445	17.008	71			111		
32	30.000 *	16.845	72			112		
33	30.000 *	31.848	73			113		
34	24.401 *	26.201	74			114		
35	26.576 *	22.687	75			115		
36	26.321 *	26.409	76			116		
37	25.195	25.784	77			117		
38	22.153	24.539	78			118		
39	23.626	21.264	79			119		
40	24.576	23.816	80			120		

Ave. cap. 1-11 cycles: AH

28.934 29.643

C/10 CHARGE RATE WITH 100 HRS POST CHARGE DELAY, TEMP = -2 °C

* Room temperature

CELL NO: Zn/AqO #12

TEST NAME: ZN12CL1, ZN12CL2

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.000	33.627	41	20.083	21.390	81	10.826 ***	13.833
2	30.001	32.562	42	20.741	20.315	82	5.626 ***	10.868
3	30.001	30.606	43	25.916	21.163	83	13.633	5.911
4	30.001	32.170	44	25.745	27.443	84	13.305	13.622
5	30.001	27.449	45	24.889	26.190	85	12.968	13.187
6	29.812	28.985	46	18.618	23.563	86	12.689	12.902
7	28.786	29.784	47	15.894	14.462	87	12.578	12.721
8	27.840	28.142	48	15.500	15.817	88		3.004
9	27.729	27.769	49	16.427	15.548	89	Terminated @ 88C	
10	28.100	27.517	50	16.806	16.277	90		
11	26.657	28.348	51	17.951	16.889	91		
12	24.361	25.861	52	17.741	17.367	92		
13	24.506	24.202	53	19.012	17.770	93		
14	23.019	25.030	54	17.975	19.160	94		
15	21.927	22.581	55	15.641	17.448	95		
16	26.313	21.860	56	15.096	15.846	96		
17	22.898	28.852	57	14.723	14.936	97		
18	19.761	21.761	58	13.828	14.713	98		
19	21.436	19.151	59	18.028	17.674 **	99		
20	30.000	22.149	60	18.034	18.535	100		
21	23.307	34.515	61	18.022	18.179	101		
22	20.462	21.136	62	17.946	18.397	102		
23	21.781	19.848	63	17.721	17.815	103		
24	17.712	20.747	64	17.463	17.597	104		
25	19.375	17.490	65	17.116	17.439	105		
26	18.176	19.892	66	16.926	17.120	106		
27	18.802	18.752	67	16.721	16.924	107		
28	19.101	19.056	68	16.417	16.747	108		
29	18.538	19.056	69	16.239	16.435	109		
30	30.000 *	22.080	70	15.915	16.236	110		
31	30.000 *	33.942	71	15.662	15.906	111		
32	24.420 *	25.073	72	6.616	15.661	112		
33	30.000 *	23.173	73	10.592 ***	7.105	113		
34	27.125 *	30.327	74	10.053 ***	10.744	114		
35	25.505	26.389	75	11.420	10.080	115		
36	22.082	24.901	76	6.513	11.500	116		
37	23.654	21.268	77	15.292	6.818	117		
38	25.882	24.351	78	14.409	15.247	118		
39	24.453	25.345	79	14.086	14.347	119		
40	19.823	20.944	80	13.884	14.065	120		

Ave. cap. 1-13 cycles: AH

28.292 29.002

C/10 CHARGE RATE WITH 100 HRS POST CHARGE DELAY, TEMP = -2 °C

* Room temperature

*** Noisy discharge voltage

** Reduced charge rate to C/30 and removed 100 hours delay

CELL NO: Zn/AgO #13

TEST NAME: ZN13CL1, ZN13CL2

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.000	36.377	41	17.709	18.387	81		
2	30.000	31.981	42	17.847	18.544	82		
3	30.001	30.582	43	17.008	17.793	83		
4	30.000	30.260	44	16.921	17.608	84		
5	30.001	30.101	45	16.491	17.145	85		
6	30.000	29.874	46	16.223	16.835	86		
7	30.000	29.822	47	15.982	16.608	87		
8	30.000	29.651	48	15.608	16.240	88		
9	30.001	29.429	49	15.396	15.982	89		
10	30.000	29.507	50	15.030	15.717	90		
11	30.001	29.533	51	14.816	15.438	91		
12	30.000	29.529	52	14.551	15.144	92		
13	30.000	29.538	53	14.476	14.890	93		
14	30.000	29.707	54	20.849	20.795 *	94		
15	30.001	29.170	55	21.571	21.752	95		
16	30.001	29.788	56	21.506	21.764	96		
17	30.001	29.457	57	21.156	21.545	97		
18	30.000	29.869	58	20.579	20.968	98		
19	30.000	29.779	59	19.942	20.310	99		
20	30.001	30.003	60	19.431	19.782	100		
21	30.001	29.441	61	18.923	19.247	101		
22	27.938	27.209	62	18.495	18.787	102		
23	28.894	29.407	63	17.992	18.303	103		
24	26.227	28.391	64	17.627	17.929	104		
25	28.093	18.364	65	17.280	17.574	105		
26	26.488	27.193	66	17.008	17.249	106		
27	25.041	25.642	67	16.688	16.958	107		
28	24.486	24.880	68	16.430	16.685	108		
29	24.020	24.609	69	16.249	16.481	109		
30	23.405	24.113	70	16.028	16.245	110		
31	22.820	23.407	71	15.871	16.088	111		
32	22.098	22.756	72	15.697	15.905	112		
33	21.584	22.166	73	15.568	15.765	113		
34	20.943	21.549	74	15.389	15.608	114		
35	20.707	21.290	75	15.228	15.450	115		
36	20.138	20.731	76	14.398	15.300	116		
37	19.208	20.477	77			117		
38	19.756	20.002	78	Terminated @ 77C		118		
39	18.726	19.328	79			119		
40	18.377	18.986	80			120		

Ave. cap. 1-29 cycles: AH
29.007 28.934

C/10 CHARGE RATE WITH 100 HRS POST CHARGE DELAY, TEMP = 35 °C

* Reduced charge rate to C/30 and removed 100 hours delay

CELL NO: Zn/AqO #14

TEST NAME: ZN14CL1

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.001	43.300	41			81		
2	30.001	29.333	42			82		
3	30.000	31.061	43			83		
4	30.000	30.352	44			84		
5	30.000	30.328	45			85		
6	30.000	29.896	46			86		
7	30.000	29.776	47			87		
8	30.000	29.610	48			88		
9	30.001	29.431	49			89		
10	30.000	29.362	50			90		
11	30.000	29.431	51			91		
12	30.000	29.433	52			92		
13	30.000	29.671	53			93		
14	30.000	29.679	54			94		
15	30.000	29.210	55			95		
16	30.000	29.838	56			96		
17	30.000	29.316	57			97		
18	30.000	29.530	58			98		
19	30.001	29.749	59			99		
20	30.000	29.667	60			100		
21	29.808	29.306	61			101		
22	26.878	27.339	62			102		
23	27.896	28.329	63			103		
24	27.595	28.076	64			104		
25	24.541	27.626	65			105		
26	26.289	26.820	66			106		
27	23.901	24.434	67			107		
28	23.309	23.895	68			108		
29		23.043 *	69			109		
30			70			110		
31			71			111		
32			72			112		
33			73			113		
34			74			114		
35			75			115		
36			76			116		
37			77			117		
38			78			118		
39			79			119		
40			80			120		

Ave. cap. 1-26 cycles: AH
29.347 29.826

C/10 CHARGE RATE WITH 100 HRS POST CHARGE DELAY, TEMP = 35 °C

* Suspended after 29 C (at rest step) to free the channel for other testing

CELL NO: Zn/AgO #15

TEST NAME: ZN15CL1

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.000	38.182	41	21.918	22.385	81		
2	30.000	30.988	42	21.212	21.768	82		
3	30.000	30.825	43	20.529	21.479 *	83		
4	30.000	30.120	44	20.252	20.077	84		
5	30.001	29.988	45	20.018	20.400	85		
6	30.001	29.735	46	19.776	20.227	86		
7	30.001	29.628	47	19.599	20.057	87		
8	30.000	29.226	48	19.315	19.744	88		
9	30.000	29.039	49	19.016	19.445	89		
10	30.000	29.189	50	18.752	19.150	90		
11	30.000	29.385	51	18.543	18.995	91		
12	30.001	29.432	52	18.379	18.787	92		
13	30.000	29.590	53	18.089	18.495	93		
14	30.000	29.715	54	17.830	18.267	94		
15	30.001	29.335	55	17.588	18.022	95		
16	30.000	29.665	56	17.511	17.948	96		
17	30.000	29.528	57	17.347	17.813	97		
18	30.000	29.679	58	17.217	17.628	98		
19	30.000	29.606	59	16.933	17.348	99		
20	30.001	29.811	60	14.497	17.010	100		
21	30.001	29.599	61	15.813	16.104	101		
22	29.221	28.108	62	15.295	15.723	102		
23	25.698	25.897	63	14.048	13.898	103		
24	27.596	27.810	64		15.610	104		
25	27.265	29.408	65	Terminated @ 64R		105		
26	29.096	29.411	66			106		
27	28.913	29.192	67			107		
28	28.475	28.862	68			108		
29	27.574	27.993	69			109		
30	26.959	27.329	70			110		
31	26.382	26.768	71			111		
32	25.898	26.294	72			112		
33	24.456	25.659	73			113		
34	24.643	25.038	74			114		
35	24.302	24.702	75			115		
36	23.689	24.175	76			116		
37	23.124	23.685	77			117		
38	22.588	22.308	78			118		
39	22.465	22.902	79			119		
40	22.064	22.658	80			120		

Ave. cap. 1 - 35 cycles: AH

28.757 28.992

C/10 CHARGE RATE WITH 100 HRS POST CHARGE DELAY, TEMP = 35 °C

* Noisy voltage @ 43R

CELL NO: Zn/AgO #16

TEST NAME: ZN16CL2

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.001	46.011	41		**	81		
2	30.000	28.789	42			82		
3	30.001	30.842	43			83		
4	30.001	30.033	44			84		
5	16.799	0.838 *	45			85		
6	30.000	41.929	46			86		
7	30.000	32.376	47			87		
8	30.000	30.882	48			88		
9	30.001	29.678	49			89		
10	30.001	29.682	50			90		
11	30.000	29.662	51			91		
12	30.000	29.828	52			92		
13	30.001	30.000	53			93		
14	30.000	29.445	54			94		
15	30.000	29.337	55			95		
16	30.001	30.416	56			96		
17	30.000	29.871	57			97		
18	30.000	29.533	58			98		
19	30.000	29.718	59			99		
20	30.001	29.784	60			100		
21	30.000	29.505	61			101		
22	30.000	29.901	62			102		
23	28.998	27.676	63			103		
24	29.499	29.126	64			104		
25	29.737	29.853	65			105		
26	29.240	30.082	66			106		
27	27.817	28.900	67			107		
28	26.475	25.808	68			108		
29	27.751	28.366	69			109		
30	27.443	27.383	70			110		
31	27.123	28.161	71			111		
32	24.011	24.144	72			112		
33	24.807	25.406	73			113		
34	23.360	23.748	74			114		
35	22.757	22.744	75			115		
36	23.519	23.620	76			116		
37	23.787	23.430	77			117		
38	23.697	23.914	78			118		
39	23.151	23.695	79			119		
40	23.162	23.413	80			120		

Ave. cap. 1-33 cycles (excluding 5th cycle): AH

29.153 30.066

C/10 CHARGE RATE WITH 100 HRS POST CHARGE DELAY, TEMP = 23 °C

* Insufficient charging, cell switched to discharge @ 1.63 V.

** Suspended @ 41 C to free the channel for other testing

CELL NO: Zn/AgO #17

TEST NAME: ZN17CL3

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.001	38.863	41	24.611	25.648	81		
2	30.001	28.753	42	24.742	25.857	82		
3	30.001	30.466	43	24.161	24.878	83		
4	30.000	30.117	44	24.135	25.031	84		
5	30.000	30.205	45	23.882	24.975	85		
6	30.001	30.151	46	22.495	23.155	86		
7	30.000	30.377	47	23.153	23.937	87		
8	30.000	30.586	48	23.028	23.923	88		
9	30.001	30.151	49	22.318	23.563	89		
10	30.001	29.731	50	22.711	23.035	90		
11	30.000	29.981	51	21.831	22.183	91		
12	30.000	29.999	52	22.003	22.438	92		
13	30.001	29.648	53	21.882	22.289	93		
14	30.001	30.051	54	21.162	21.701	94		
15	30.000	29.675	55	20.569	21.058	95		
16	30.000	30.524	56	20.062	20.538	96		
17	30.001	30.005	57	20.278	20.727	97		
18	30.000	29.832	58	19.851	20.354	98		
19	30.000	30.262	59	19.754	20.298	99		
20	30.001	29.825	60	19.185	19.750	100		
21	30.000	29.488	61	18.709	19.218	101		
22	29.725	29.015	62	18.321	18.932	102		
23	27.073	26.385	63	17.764	18.277	103		
24	28.328	28.190	64	17.387	17.980	104		
25	29.415	29.262	65	17.098	17.624	105		
26	29.474	29.877	66	16.608	17.178	106		
27	29.462	29.519	67	16.195	16.677	107		
28	28.690	29.087	68	16.076	16.528	108		
29	28.818	29.354	69	14.927	16.238	109		
30	29.629	30.008	70	15.641	16.197	110		
31	29.029	29.869	71	15.252	15.639	111		
32	27.296	27.980	72	15.416	15.844	112		
33	25.638	26.133	73	14.949	15.610	113		
34	24.852	25.748	74	14.970	15.443	114		
35	38.769 *	24.885	75	7.899	15.399	115		
36	24.668 *	23.731	76	14.412	15.033	116		
37	22.828	23.587	77		14.675	117		
38	24.048	25.321	78	Terminated @ 77R		118		
39	24.417	25.471	79			119		
40	24.374	25.383	80			120		

Ave. cap. 1-36 cycles: AH

29.469 29.381

C/10 CHARGE RATE WITH 100 HRS POST CHARGE DELAY, TEMP = 23 °C

* Station malfunction, test was re-started itself under same file name several times

CELL NO: Zn/AgO #18

TEST NAME: ZN18CL2, ZN18CL3

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.001	34.247	41	21.733	22.560	81	16.288	16.536
2	30.001	26.354	42	20.809	20.994	82	16.127	16.314
3	30.001	32.871	43	21.423	22.099	83	15.976	16.189
4	30.001	30.624	44	20.737	21.426	84	15.833	16.089
5	30.001	30.471	45	20.114	20.658	85	15.745	15.875
6	30.001	29.628	46	19.712	20.046	86	15.642	15.795
7	30.001	29.880	47	19.739	19.949	87	15.490	15.699
8	30.001	30.661	48	20.460	21.003	88		14.776
9	30.001	29.597	49	20.174	20.685	89	Terminated @ 88D	
10	30.001	29.790	50	20.384	20.637	90		
11	30.000	29.592	51	19.908	20.327	91		
12	30.000	29.831	52	19.653	20.325	92		
13	30.000	29.780	53	19.070	19.397	93		
14	30.000	29.574	54	19.245	19.808	94		
15	30.000	29.515	55	18.308	19.037	95		
16	30.001	30.198	56	18.116	18.705	96		
17	30.000	29.915	57	18.150	18.608	97		
18	30.001	29.658	58	17.702	18.374	98		
19	30.001	30.047	59	17.292	17.826	99		
20	30.000	29.919	60	16.789	17.376	100		
21	30.001	29.570	61	16.393	17.018	101		
22	30.000	30.412	62	15.963	16.638	102		
23	27.080	28.290	63	15.465	16.026	103		
24	27.722	28.187	64	15.150	15.789	104		
25	29.101	28.877	65	14.007	15.200	105		
26	29.006	29.734	66	19.906	19.881 *	106		
27	28.752	29.121	67	20.296	20.483	107		
28	27.723	27.638	68	20.981	21.288	108		
29	28.668	29.264	69	21.140	21.426	109		
30	28.665	28.510	70	20.910	21.327	110		
31	28.312	29.529	71	20.384	20.849	111		
32	25.963	25.848	72	19.763	20.191	112		
33	26.620	27.240	73	19.237	19.607	113		
34	24.651	25.049	74	18.809	19.112	114		
35	24.141	24.168	75	18.391	18.720	115		
36	20.185	15.927	76	18.023	18.320	116		
37	21.849	20.863	77	17.666	17.922	117		
38	21.790	22.271	78	17.405	17.624	118		
39	21.384	22.010	79	16.935	17.277	119		
40	21.507	21.599	80	16.600	16.877	120		

Ave. cap. 1-35 cycles: AH

29.040 29.245

C/10 CHARGE RATE WITH 100 HRS POST CHARGE DELAY, TEMP = 23 °C

* Reduced charge rate to C/30 and removed 100 hours delay

CELL NO: Zn/AgO #19

TEST NAME: AGPIIP19

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.000	44.051	41	21.042	21.264	81	14.112	13.930
2	30.002	27.858	42	20.614	20.802	82	14.535	14.317
3	30.001	30.500	43	20.461	20.689	83	13.693	14.423
4	30.000	30.152	44	19.944	20.127	84	12.878	13.213
5	30.001	29.785	45	19.658	19.873	85	11.947	12.671
6	30.001	26.589	46	20.943	21.851	86	11.471	11.701
7	30.001	29.915	47	20.852	21.563	87	11.667	11.638
8	30.000	29.086	48	20.649	21.218	88	11.654	11.857
9	30.001	29.513	49	20.259	20.528	89	10.937	11.425
10	30.000	29.118	50	20.131	20.315	90	10.683	10.787
11	30.001	28.996	51	19.667	19.912	91	10.912	10.762
12	30.002	29.483	52	19.633	19.753	92	11.631	11.274
13	30.000	29.840	53	19.303	19.423	93	10.493	11.544
14	30.001	29.477	54	19.294	19.400	94	10.206	10.253
15	30.001	29.396	55	18.653	18.950	95	11.835	10.298
16	30.000	28.152	56	18.437	18.583	96	11.009	12.506
17	29.677	29.546	57	18.454	18.570	97	11.330	11.009
18	29.388	29.413	58	18.118	18.274	98	10.468	11.278
19	29.800	29.815	59	18.282	18.276	99	13.434	10.486
20	29.376	29.564	60	17.893	18.140	100	11.304	13.667
21	28.610	28.903	61	17.028	17.474	101		
22	25.447	26.378	62	16.100	16.695	102		
23	24.469	24.757	63	14.884	15.454	103	Terminated @ 200D	
24	23.828	24.093	64	14.243	14.623	104		
25	23.570	23.745	65	13.889	14.249	105		
26	23.281	23.338	66	13.076	14.670	106		
27	23.853	24.017	67	13.222	14.705	107		
28	23.668	23.859	68	14.133	14.359	108		
29	24.187	24.298	69	14.507	13.941	109		
30	24.268	24.249	70	14.564	14.121	110		
31	23.367	23.992	71	14.575	14.670	111		
32	22.435	22.456	72	14.506	14.705	112		
33	23.206	23.250	73	13.933	14.359	113		
34	23.485	23.544	74	13.999	13.941	114		
35	22.781	23.229	75	13.737	14.121	115		
36	21.474	21.759	76	12.554	13.195	116		
37	21.749	21.941	77	14.838	13.020	117		
38	21.207	21.439	78	14.098	15.293	118		
39	21.244	21.323	79	13.244	13.962	119		
40	21.148	21.173	80	13.436	13.287	120		

Ave. cap. 1-23 cycles: AH

29.425 29.578

2 MONTH STORAGE @ R/T IN FULLY DISCHARGED STATE (AFTER FORMING)

(NOTE: FILL DATE = 11/30/90, TEST DATE = 02/01/91)

TESTED AT C/10 CHARGE RATE @ R/T

CELL NO: Zn/AgO #20

TEST NAME: AGPIIP20

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1		33.742 *	41			81		
2		30.001 *	42			82		
3		30.000 *	43			83		
4		30.001 *	44			84		
5		10.849 *	45			85		
6			46			86		
7			47			87		
8			48			88		
9			49			89		
10			50			90		
11			51			91		
12			52			92		
13			53			93		
14			54			94		
15			55			95		
16			56			96		
17			57			97		
18			58			98		
19			59			99		
20			60			100		
21			61			101		
22			62			102		
23			63			103		
24			64			104		
25			65			105		
26			66			106		
27			67			107		
28			68			108		
29			69			109		
30			70			110		
31			71			111		
32			72			112		
33			73			113		
34			74			114		
35			75			115		
36			76			116		
37			77			117		
38			78			118		
39			79			119		
40			80			120		

2 MONTH STORAGE @ R/T IN FULLY DISCHARGED STATE (AFTER FORMING)

(NOTE: FILL DATE = 11/30/90, TEST DATE = 02/01/91)

TESTED AT C/10 CHARGE RATE @ R/T

*Station malfunction. Cell did not switched to discharge after completed charge.

Total charge capacity was 134.59 AH. Final cell volatqe was 5.199 V. Cell vented.

CELL NO: Zn/AqO #21

TEST NAME: AGPIIP21

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.001	34.788	41	21.211	21.456	81	14.535	13.930
2	30.002	30.253	42	20.962	21.126	82	13.731	14.317
3	30.001	30.437	43	20.947	21.135	83	12.819	14.423
4	30.000	29.994	44	20.482	20.803	84	13.046	13.213
5	30.002	29.213	45	17.793	20.452	85	13.163	12.671
6	30.001	29.459	46	21.356	21.841	86	12.190	11.701
7	30.001	31.133	47	21.381	21.664	87	11.933	11.638
8	30.003	28.635	48	21.323	21.626	88	14.560	11.857
9	30.001	29.726	49	21.281	21.343	89	12.401	11.425
10	30.002	29.034	50	21.098	21.341	90	11.311	10.787
11	30.001	28.787	51	20.877	20.867	91	11.304	10.762
12	30.001	29.731	52	20.687	20.948	92	16.296	11.274
13	30.001	29.891	53	20.646	20.521	93	13.224	11.544
14	30.001	29.335	54	20.059	20.545	94	12.043	10.253
15	30.001	29.669	55	19.643	19.840	95	11.822	10.298
16	30.002	29.582	56	19.396	19.689	96	11.988	12.506
17	30.001	30.264	57	19.468	19.449	97	11.750	11.009
18	30.000	29.567	58	19.188	19.412	98	11.541	11.278
19	29.898	29.695	59	19.412	19.300	99	12.058	10.486
20	28.692	28.879	60	18.301	19.082	100	11.464	13.667
21	28.166	28.392	61	17.074	17.874	101		
22	25.783	26.671	62	15.478	16.384	102	Terminated @ 200D	
23	24.475	24.892	63	15.026	15.317	103		
24	24.019	24.436	64	14.694	15.229	104		
25	23.714	24.129	65	13.961	14.193	105		
26	23.268	23.465	66	14.711	14.437	106		
27	23.973	24.227	67	17.357	15.421	107		
28	23.666	24.033	68	16.444	17.681	108		
29	24.216	24.342	69	15.835	16.435	109		
30	24.363	24.427	70	15.628	15.956	110		
31	23.507	24.291	71	15.202	15.436	111		
32	22.238	22.430	72	14.874	15.095	112		
33	23.291	23.403	73	14.880	14.996	113		
34	23.462	23.538	74	13.482	14.335	114		
35	22.817	23.337	75	19.006	13.942	115		
36	21.352	21.774	76	16.813	18.935	116		
37	21.961	22.078	77	15.529	16.677	117		
38	21.407	21.715	78	15.987	16.153	118		
39	21.400	21.592	79	16.141	16.258	119		
40	21.164	21.329	80	15.184	15.975	120		

Ave. cap. 1-24 cycles: AH

29.211

29.269

2 MONTH STORAGE @ R/T IN FULLY DISCHARGED STATE (AFTER FORMING)

(NOTE: FILL DATE = 11/30/90, TEST DATE = 02/01/91)

TESTED AT C/10 CHARGE RATE @ R/T

CELL NO: Zn/AgO #22

TEST NAME: ZN22A, ZN22B, ZN22CL3

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.000	46.821	41	24.195	24.450	81	19.233	19.338
2	30.001	26.428	42	23.442	23.665	82	19.176	19.237
3	30.001	30.725	43	23.165	23.364	83	19.087	19.173
4	30.000	29.683	44	23.949	25.256	84	19.114	19.181
5	30.000	29.668	45	23.945	24.004	85	19.120	19.208
6	30.000	29.589	46	22.918	23.095	86	17.741 *	19.146
7	30.000	29.430	47	22.563	22.665	87	19.604	18.293
8	30.001	29.297	48	22.006	22.078	88	19.073	19.266
9	30.001	29.334	49	22.025	22.159	89	18.861	18.838
10	30.001	29.459	50	21.498	21.675	90	18.828	18.937
11	30.001	29.361	51	21.498	21.625	91	18.590	18.693
12	30.000	29.320	52	21.291	21.437	92	18.409	18.538
13	30.000	29.393	53	21.277	21.391	93	18.225	18.351
14	30.001	29.337	54	20.990	21.172	94	18.166	18.248
15	30.000	29.245	55	20.947	21.110	95	18.058	18.164
16	30.000	29.330	56	20.828	20.950	96	17.946	18.077
17	30.001	29.723	57	20.826	20.960	97	17.857	17.964
18	30.000	30.378	58	22.405	22.550	98	17.647	17.744
19	30.001	29.134	59	21.595	21.765	99	17.811	17.898
20	30.000	30.638	60	21.529	21.673	100	17.796	17.922
21	30.000	28.451	61	21.020	21.199	101	19.487	19.417
22	30.000	29.739	62	20.839	20.972	102	18.034	18.266
23	27.524	26.884	63	20.497	20.659	103	17.560	17.696
24	28.193	28.251	64	20.397	20.534	104	17.454	17.608
25	29.852	29.869	65	20.262	20.388	105	17.188	17.350
26	30.001	30.275	66	20.354	20.484	106	17.059	17.205
27	29.894	29.843	67	19.967	20.117	107	16.959	17.090
28	29.599	29.702	68	20.226	20.040	108	17.813	17.022
29	29.145	29.190	69	20.387	20.592	109	17.267	17.466
30	28.504	28.638	70	20.505	20.527	110	17.957	18.252
31	28.081	28.139	71	20.239	20.499	111	17.276	17.794
32	27.294	27.417	72	20.093	20.239	112	17.102	17.381
33	27.151	27.078	73	19.674	19.463	113	16.866	17.107
34	26.159	26.299	74	19.693	19.824	114	16.682	16.776
35	15.838	25.868	75	19.461	19.592	115	16.498	16.709
36	25.211	25.325	76	19.321	19.433	116	16.291	16.466
37	24.840	24.901	77	19.216	19.297	117	16.184	16.354
38	25.001	24.448	78	19.296	19.358	118	16.055	16.188
39	25.879	26.144	79	19.231	19.346	119	15.969	16.103
40	25.061	25.347	80	19.259	19.333	120	15.807	16.006

Ave. cap. 1-41 cycles: AH
28.474 28.843

C/10 CHARGE RATE @ 35 °C

*Insufficient discharging, cell switched at 1.481 V.

CELL NO: Zn/AgO #22

TEST NAME: ZN22A, ZN22B, ZN22CL3

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
121	15.655	15.855	161			201		
122	16.138	15.689	162			202		
123	16.641	16.972	163			203		
124	15.963	16.177	164			204		
125	15.558	15.854	165			205		
126	15.401	15.616	166			206		
127	15.126	15.379	167			207		
128	14.970	15.194	168			208		
129	14.870	15.037	169			209		
130	14.684	14.895	170			210		
131	14.624	14.761	171			211		
132	14.482	14.657	172			212		
133	14.378	14.532	173			213		
134	14.260	14.408	174			214		
135	14.248	14.376	175			215		
136	14.148	14.287	176			216		
137	14.070	14.180	177			217		
138	15.042	14.060	178			218		
139	14.171	14.571	179			219		
140	14.504	14.834	180			220		
141	Terminated @ 140D		181			221		
142			182			222		
143			183			223		
144			184			224		
145			185			225		
146			186			226		
147			187			227		
148			188			228		
149			189			229		
150			190			230		
151			191			231		
152			192			232		
153			193			233		
154			194			234		
155			195			235		
156			196			236		
157			197			237		
158			198			238		
159			199			239		
160			200			240		

CELL NO: Zn/AgO #23

TEST NAME: ZN23A, ZN23B, ZN23CL3

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.000	47.614	41	23.755	23.922	81	18.899	19.076
2	30.001	28.130	42	24.382	25.188	82	18.860	18.949
3	30.001	30.194	43	24.293	24.498	83	18.773	18.923
4	30.001	29.884	44	23.805	23.933	84	18.660	18.813
5	30.000	29.639	45	23.451	23.756	85	2.765	2.560 *
6	30.000	29.537	46	23.015	23.263	86	18.630	18.823
7	30.000	29.454	47	22.069	22.293	87	18.631	18.787
8	30.000	29.467	48	22.081	22.325	88	18.378	17.432
9	30.001	29.634	49	21.821	22.123	89	18.385	18.583
10	30.000	29.447	50	21.854	22.079	90	18.141	18.357
11	30.000	29.495	51	21.563	21.862	91	18.013	18.144
12	30.001	29.456	52	21.372	21.645	92	17.843	18.015
13	30.001	29.486	53	21.137	21.364	93	17.714	17.861
14	30.001	29.510	54	21.072	21.288	94	17.577	17.786
15	30.001	29.565	55	20.931	21.242	95	17.520	17.694
16	30.001	27.490	56	21.158	20.838	96	17.401	17.594
17	30.000	31.356	57	21.876	22.207	97	17.307	17.507
18	30.000	29.903	58	21.113	21.383	98	17.216	17.392
19	30.001	29.150	59	20.964	21.183	99	17.095	17.280
20	30.001	30.079	60	20.643	20.873	100	17.750	17.854
21	30.001	29.716	61	20.531	20.809	101	17.524	17.707
22	30.000	29.137	62	20.295	20.551	102	17.186	17.392
23	28.750	27.431	63	20.243	20.485	103	17.037	17.246
24	27.642	28.129	64	20.246	20.457	104	16.843	17.010
25	29.917	30.169	65	20.163	20.354	105	16.659	16.832
26	30.001	30.377	66	20.076	20.255	106	16.512	16.614
27	29.963	30.099	67	20.005	20.134	107	16.375	16.521
28	29.266	29.536	68	20.052	20.090	108	16.258	16.376
29	29.000	29.141	69	20.121	20.342	109	16.174	16.296
30	28.601	28.255	70	20.078	20.262	110	16.066	16.225
31	28.092	28.294	71	19.879	19.154	111	15.930	16.088
32	27.606	27.811	72	19.687	19.849	112	15.845	15.973
33	27.071	27.291	73	19.493	19.685	113	15.720	15.913
34	26.619	26.879	74	19.346	19.502	114	15.617	15.741
35	26.191	26.403	75	19.240	19.364	115	15.500	15.658
36	25.699	25.967	76	19.286	19.415	116	15.410	15.545
37	25.429	25.613	77	19.192	19.370	117	15.351	15.477
38	25.013	25.185	78	19.134	19.275	118	15.260	15.430
39	24.457	24.673	79	19.020	19.186	119	15.106	15.293
40	24.019	24.265	80	18.982	19.112	120	15.029	15.136

Ave. Cap.1 - 40 cycles: AH

28.834 29.071

C/10 CHARGE RATE @ 35 °C

*Station malfunction: cell was switched at 1.638 V.

CELL NO: Zn/AgO #23

TEST NAME: ZN23A,ZN23B,ZN23CL3

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
121	14.968	15.128	161	11.501	11.599	201		
122	14.821	14.904	162	11.408	11.515	202		
123	14.767	14.876	163	11.292	11.425	203		
124	14.724	14.849	164	11.204	11.334	204		
125	14.537	13.687	165	11.203	11.282	205		
126	14.526	14.601	166	11.163	11.232	206		
127	14.444	14.578	167	11.122	11.197	207		
128	14.316	14.461	168	11.000	11.128	208		
129	14.255	14.374	169	10.926	11.018	209		
130	14.145	14.277	170	10.783	10.925	210		
131	14.126	14.207	171	10.708	10.798	211		
132	14.003	14.108	172	10.589	10.692	212		
133	13.859	13.973	173	10.610	10.647	213		
134	13.719	13.846	174	10.480	10.608	214		
135	13.618	13.750	175	10.414	10.510	215		
136	13.527	13.657	176	10.387	10.462	216		
137	13.382	13.515	177	10.354	10.440	217		
138	13.096	13.217	178	10.307	10.392	218		
139	13.227	13.274	179	10.239	10.327	219		
140	13.143	13.242	180	10.148	10.265	220		
141	13.030	13.166	181	10.093	10.189	221		
142	12.946	13.030	182	10.009	10.120	222		
143	12.876	12.993	183	9.958	10.040	223		
144	12.776	12.891	184	9.841	9.975	224		
145	12.702	12.819	185	9.752	9.846	225		
146	12.662	12.761	186	9.723	9.797	226		
147	12.546	12.665	187	9.711	9.768	227		
148	12.467	12.561	188	9.672	9.744	228		
149	12.480	12.568	189	9.650	9.728	229		
150	12.402	12.474	190	9.661	9.683	230		
151	12.336	12.430	191	9.681	9.716	231		
152	12.267	12.349	192	9.607	9.671	232		
153	12.239	12.305	193		9.631	233		
154	12.164	12.245	194	Terminated @ 193D		234		
155	12.118	12.196	195			235		
156	11.994	12.108	196			236		
157	11.883	12.014	197			237		
158	11.703	11.845	198			238		
159	11.644	11.753	199			239		
160	11.541	11.666	200			240		

CELL NO: Zn/AgO #24

TEST NAME: ZN24A,ZN24B,ZN24CL3

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.000	45.601	41	24.103	24.175	81	19.300	19.401
2	30.000	33.357	42	24.699	25.181	82	19.205	19.301
3	30.001	29.363	43	23.991	24.111	83	19.030	19.115
4	30.001	30.023	44	23.323	23.403	84	18.936	19.008
5	30.001	29.589	45	23.025	23.144	85	18.831	18.930
6	30.001	29.709	46	22.625	22.690	86	18.645	18.766
7	30.001	29.488	47	22.707	22.770	87	18.474	17.744
8	30.000	29.418	48	22.219	22.321	88	18.476	18.623
9	30.001	29.338	49	22.057	22.141	89	18.303	18.442
10	30.000	29.297	50	21.850	21.954	90	18.258	18.370
11	30.001	29.453	51	21.615	21.715	91	18.047	18.253
12	30.000	29.403	52	21.433	21.532	92	17.952	18.106
13	30.001	29.362	53	21.321	21.438	93	17.847	18.013
14	30.001	29.403	54	21.271	21.358	94	17.776	17.959
15	30.000	29.292	55	21.148	21.285	95	17.717	17.915
16	30.000	27.167	56	21.836	21.905	96	17.614	17.829
17	30.000	30.549	57	21.934	22.104	97	17.530	17.763
18	30.000	29.841	58	21.590	21.712	98	17.375	17.643
19	30.000	29.481	59	21.168	21.313	99	19.293	19.267
20	30.001	29.777	60	20.867	20.977	100	17.939	18.200
21	30.001	29.540	61	20.533	20.664	101	17.368	17.645
22	30.001	29.611	62	20.401	20.520	102	17.108	17.376
23	30.001	28.301	63	20.319	20.460	103	16.949	17.211
24	27.792	27.783	64	20.454	20.559	104	16.717	16.927
25	28.961	29.040	65	20.439	20.564	105	16.714	16.914
26	29.766	29.774	66	20.407	20.519	106	16.578	16.785
27	29.722	29.771	67	20.336	20.442	107	16.520	16.640
28	29.419	29.441	68	20.331	20.330	108	16.293	16.443
29	28.970	28.959	69	20.247	20.438	109	16.159	16.320
30	28.574	28.059	70	20.193	20.341	110	16.208	16.364
31	28.135	28.189	71	20.315	20.227	111	15.944	16.070
32	27.737	27.762	72	19.998	20.120	112	15.999	16.142
33	27.110	27.245	73	19.881	19.991	113	15.878	15.958
34	26.791	26.859	74	19.699	19.789	114	15.858	16.001
35	26.293	26.345	75	19.533	19.634	115	15.799	15.882
36	25.959	26.009	76	19.543	19.617	116	15.578	15.699
37	25.767	25.848	77	19.411	19.544	117	15.465	15.584
38	25.631	25.687	78	19.418	19.484	118	15.344	15.428
39	24.784	24.856	79	19.352	19.471	119	15.349	15.440
40	24.474	24.502	80	19.371	19.417	120	14.446	15.325

Ave. Cap.1-42 cycles: AH

29.255

29.427

C/10 CHARGE RATE AT 35 °C

CELL NO: Zn/AgO #24

TEST NAME: ZN24A,ZN24B,ZN24CL3

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
121	15.100	15.208	161	11.887	11.950	201		
122	15.020	15.147	162	11.862	11.943	202		
123	14.940	15.004	163	11.819	11.880	203		
124	14.857	14.950	164	11.684	11.804	204		
125	14.686	14.813	165	11.532	11.609	205		
126	14.587	14.652	166	11.499	11.596	206		
127	14.556	14.661	167	11.391	11.491	207		
128	14.435	14.562	168	11.292	11.379	208		
129	14.380	14.452	169	11.313	11.400	209		
130	14.325	14.394	170	11.212	11.283	210		
131	14.214	14.301	171	11.106	11.190	211		
132	14.041	14.167	172	11.116	11.148	212		
133	13.967	14.087	173	11.137	11.166	213		
134	13.868	13.998	174	11.091	11.146	214		
135	13.730	13.808	175	11.019	11.127	215		
136	13.407	13.503	176	10.915	11.008	216		
137	13.636	13.681	177	10.885	10.938	217		
138	13.548	13.617	178	10.852	10.892	218		
139	13.458	13.554	179	10.763	10.850	219		
140	13.418	13.487	180	10.640	10.733	220		
141	13.315	13.401	181	10.681	10.709	221		
142	13.227	13.295	182	10.617	10.688	222		
143	13.206	13.286	183	10.564	10.621	223		
144	13.110	13.183	184	10.518	10.574	224		
145	13.032	13.107	185	10.494	10.556	225		
146	12.981	13.043	186	10.475	10.501	226		
147	12.919	13.013	187	10.407	10.485	227		
148	12.800	12.872	188		10.413	228		
149	12.722	12.808	189	Terminated @ 188D		229		
150	12.662	12.698	190			230		
151	12.640	12.697	191			231		
152	12.538	12.604	192			232		
153	12.478	12.530	193			233		
154	12.369	12.435	194			234		
155	12.298	12.360	195			235		
156	12.164	12.257	196			236		
157	12.106	12.200	197			237		
158	12.064	12.139	198			238		
159	11.977	12.061	199			239		
160	11.855	11.942	200			240		

CELL NO: Zn/AqO #25

TEST NAME: ZNI25S

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.000	41.160	41	16.151	16.589	81	Terminated @ 127D	
2	30.000	35.650	42	16.050	15.965	82		
3	30.000	43.010	43	16.823	16.705	83		
4	30.000	37.490	44	16.072	16.472	84		
5	30.000	29.650	45	16.476	16.327	85		
6	30.000	29.520	46	16.944	16.913	86		
7	30.000	29.360	47	16.437	16.782	87		
8	30.000	29.330	48	16.451	16.396	88		
9	30.000	29.280	49	16.428	16.700	89		
10	30.000	30.130	50	15.701	16.026	90		
11	30.001 **	29.040 *	51	16.273	15.990	91		
12	30.000	27.719	52	16.029	16.433	92		
13	30.001	29.099	53	15.649	15.871	93		
14	30.001	28.628	54	15.503	15.575	94		
15	28.190	27.764	55	15.114	15.356	95		
16	27.140	27.445	56	14.634	14.883	96		
17	27.769	25.384	57	15.100	14.993	97		
18	28.300	28.491	58	14.596	14.839	98		
19	28.210	28.419	59	14.040	14.264	99		
20	27.670	27.826	60	14.419	14.287	100		
21	26.982	27.247	61	14.338	14.520	101		
22	26.234	26.442	62	13.589	13.885	102		
23	24.733	25.007	63	13.671	13.684	103		
24	24.098	24.256	64	13.311	13.551	104		
25	22.514	22.725	65	12.805	13.025	105		
26	22.418	22.478	66	12.898	12.873	106		
27	21.471	21.594	67	12.634	12.873	107		
28	21.532	21.593	68	11.880	12.250	108		
29	20.968	21.048	69	11.958	11.833	109		
30	20.739	20.862	70	12.506	9.680	110		
31	19.853	20.074	71	12.266	12.489	111		
32	19.380	19.523	72	11.809	12.016	112		
33	18.539	18.864	73	12.077	11.970	113		
34	18.080	17.906	74	17.445	9.148	114		
35	18.179	18.322	75	14.706	14.702	115		
36	17.080	17.322	76	14.681	14.678	116		
37	17.181	17.215	77	14.464	14.784	117		
38	16.867	17.012	78	13.764	14.044	118		
39	16.537	16.605	79	13.837	13.515	119		
40	16.912	16.829	80	13.962	13.983	120		

Ave. cap. 1-24 cycles: AH

28.722

29.889

C/10 CHARGE RATE FOR 10 CYCLES @ 35 °C, CELL THEN STORED @ R/T
FOR 3 MONTHS AFTER 11th CHARGE.

* On storage for 3 months @ R/T

** Back on test after storage

CELL NO: Zn/AqO #26

TEST NAME: ZNI26S

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.000	50.000	41	14.812	13.325	81		
2	30.000	50.000	42	12.941	14.230	82		
3	30.000	27.130	43	14.371	13.393	83		
4	30.000	28.980	44	13.794	14.011	84		
5	30.000	29.210	45	13.831	13.844	85		
6	30.000	29.350	46	14.761	13.973	86		
7	30.000	29.140	47	13.234	14.354	87		
8	30.000	29.010	48	14.573	13.469	88		
9	30.000	29.210	49	13.893	14.355	89		
10	30.000	29.280	50	14.249	14.029	90		
11	30.000 **	28.480 *	51	13.381	13.598	91		
12	30.001	29.942	52	14.029	13.813	92		
13	30.000	29.216	53	14.430	14.109	93		
14	30.000	25.810	54	13.356	13.920	94		
15	29.986	27.028	55	14.274	13.713	95		
16	22.327	22.319	56	14.265	14.321	96		
17	22.323	22.535	57	14.024	14.076	97		
18	19.988	19.233	58	13.471	13.628	98		
19	21.761	19.352	59	14.038	13.921	99		
20	18.863	21.087	60	13.842	13.977	100		
21	18.304	18.140	61	13.423	13.566	101		
22	19.445	17.221	62			102		
23	15.356	17.508	63	Terminated @ 156C		103		
24	13.843	13.816	64			104		
25	14.897	12.634	65			105		
26	11.032	13.332	66			106		
27	16.753	14.341	67			107		
28	16.217	17.522	68			108		
29	16.828	15.358	69			109		
30	15.949	17.511	70			110		
31	18.913	17.131	71			111		
32	15.481	17.114	72			112		
33	16.784	15.002	73			113		
34	14.316	15.967	74			114		
35	17.077	15.390	75			115		
36	15.299	16.895	76			116		
37	16.915	15.244	77			117		
38	14.160	15.765	78			118		
39	15.778	14.226	79			119		
40	13.622	15.078	80			120		

Ave. cap. 1-15 cycles: AH

29.999 31.452

C/10 CHARGE RATE FOR 10 CYCLES @ 35 °C, CELL THEN STORED @ R/T
FOR 3 MONTHS AFTER THE 11th CHARGE.

* On storage for 3 months @ R/T

** Back on test after storage

CELL NO: Zn/AgO #27

TEST NAME: ZNI27S

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.000	36.950	41	19.107	18.846	81	15.155	15.506
2	30.000	30.280	42	19.025	19.331	82	14.646	14.719
3	30.000	30.530	43	18.874	18.742	83	15.130	15.046
4	30.000	29.910	44	19.649	19.602	84	14.533	14.863
5	30.000	29.770	45	19.084	19.371	85	14.112	14.279
6	30.000	29.410	46	19.407	19.167	86	14.585	14.449
7	30.000	29.050	47	18.925	19.228	87	14.189	14.415
8	30.000	28.900	48	18.798	18.644	88	13.858	13.887
9	30.000	28.990	49	19.475	19.596	89	14.147	14.162
10	30.000	29.050	50	18.747	18.872	90	13.999	14.020
11	30.000 **	29.380 *	51	18.747	18.749	91	13.520	13.771
12	30.000	31.018	52	18.088	18.346	92	13.717	13.607
13	30.000	29.044	53	18.258	17.961	93	13.628	13.788
14	30.001	28.340	54	18.034	18.233	94	13.438	13.526
15	30.000	28.919	55	17.559	17.650	95	13.069	12.394
16	29.353	29.056	56	18.057	17.950	96	12.788	12.913
17	27.263	27.168	57	17.483	17.737	97	12.371	12.632
18	27.559	27.507	58	17.237	17.253	98	12.442	12.317
19	27.369	27.453	59	16.915	17.076	99	12.413	12.543
20	26.500	26.538	60	16.597	16.586	100	12.303	12.356
21	25.813	26.003	61	16.742	16.759	101	11.830	12.141
22	25.417	25.505	62	15.863	16.205	102	12.119	11.869
23	24.220	24.411	63	15.918	15.792	103	11.932	12.200
24	24.158	24.237	64	16.230	15.121	104	11.972	11.869
25	22.891	23.121	65	15.667	15.833	105	11.466	11.841
26	23.210	23.232	66	15.909	15.804	106	11.995	11.435
27	22.098	22.275	67	19.845	10.795	107	11.485	11.983
28	22.507	22.531	68	17.916	17.520	108	11.211	11.394
29	21.910	22.088	69	17.618	17.804	109	10.381	11.088
30	21.827	22.010	70	16.572	16.887	110		
31	21.025	21.232	71	16.529	16.391	111	Terminated @ 110C	
32	20.915	20.995	72	16.663	16.693	112		
33	19.872	20.225	73	16.508	16.428	113		
34	20.426	20.198	74	17.008	16.807	114		
35	19.775	20.133	75	16.576	16.694	115		
36	19.477	19.474	76	16.483	16.428	116		
37	19.398	19.574	77	16.372	16.504	117		
38	19.103	19.134	78	15.631	15.955	118		
39	19.495	19.508	79	15.178	15.297	119		
40	18.455	18.854	80	15.733	15.568	120		

Ave. cap. 1-24 cycles: AH

28.652 28.642

C/10 CHARGE RATE FOR 10 CYCLES @ 35 °C, CELL THEN STORED @ R/T
FOR 3 MONTHS AFTER THE 11th CHARGE.

* On storage for 3 months @ R/T

** Back on test after storage

CELL NO: Zn/AgO #48

TEST NAME: AGSTRO46

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.000	30.973	41	20.725	20.843	81	17.376	17.406
2	30.000	37.309	42	20.526	20.534	82	17.557	17.691
3	30.000	31.525	43	20.808	20.929	83	16.970	17.017
4	30.000	31.445	44	7.699 **	20.373	84	17.555	17.583
5	30.000	29.600	45	21.987	9.430	85	17.292	17.488
6	30.000	29.584	46	21.651	21.752	86	17.199	17.175
7	30.000	28.345	47	21.362	21.416	87	17.604	17.692
8	30.000 *	29.163 *	48	20.101	20.255	88	16.987	17.084
9	30.000	29.435	49	19.752	19.754	89	17.480	17.483
10	30.000	29.915	50	19.886	20.035	90	17.543	17.622
11	30.000	29.538	51	19.135	19.174	91	17.700	17.715
12	30.000	29.019	52	19.837	19.967	92	17.786	17.882
13	30.000	29.799	53	19.120	19.169	93	17.646	17.700
14	30.000	29.339	54	19.819	19.875	94	17.870	17.931
15	27.787 *	28.418	55	19.944	20.060	95	17.565	17.760
16	29.280	27.460 *	56	19.996	20.084	96	17.218	17.195
17	27.662 *	27.778 *	57	19.962	20.092	97	17.697	17.733
18	27.649	27.905	58	18.883	19.969	98	17.176	17.333
19	27.446	27.590 *	59	20.216	19.313	99	17.338	17.228
20	13.211 *	27.034 *	60	19.668	19.883	100	17.972	18.075
21	27.941	14.355	61	19.500	19.589	101	17.320	17.400
22	27.134	27.342	62	19.035	19.160	102	18.373	18.290
23	26.904	27.092	63	19.218	19.285	103	17.878	18.078
24	26.378	26.463	64	18.890	18.992	104	17.068	17.281
25	25.363	25.487	65	11.560	13.203 **	105	16.667	16.799
26	25.313	25.392	66	19.153	19.222	106	16.720	16.690
27	24.341	24.436	67	19.801	19.955	107	18.055	17.869
28	24.333	24.443	68	18.888	18.997	108	18.210	18.229
29	23.619	23.704	69	18.893	18.984	109	18.837	18.741
30	23.266	23.385	70	18.094	18.205	110	18.511	18.634
31	22.224	19.368	71	17.964	17.983	111	18.484	18.466
32	22.095	22.200	72	17.821	17.876	112	18.629	18.695
33	21.032	21.079	73	17.801	17.850	113	18.003	18.187
34	21.680	21.796	74	17.824	17.916	114	17.949	17.936
35	20.480	20.550	75	17.715	17.781	115	17.997	18.097
36	20.997	21.071	76	17.598	17.669	116	17.593	14.379
37	20.687	20.742	77	17.438	17.545	117	17.593	18.153
38	20.899	20.993	78	17.040	17.032	118	18.147	17.932
39	20.620	20.717	79	18.133	18.065	119	17.707	17.495
40	20.753	20.814	80	17.742	17.938	120	17.790	17.838

Ave. Cap. 1-28 cycles: AH

27.884 28.078

3 MONTH STORAGE @ R/T IN FULLY DISCHARGED STATE

* Noisy voltage- (+) nut slightly loose, enough to cause problem-- Fixed 5/28/91 15:35

** 44 D & 65 C: End voltage of that half cycle = 0.0 V.

CELL NO: Zn/AgO #46 TEST NAME: AGSTRQ46

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
121	17.033	17.234	161			201		
122	17.435	17.390	162			202		
123	17.195	17.378	163			203		
124			164			204		
125	Terminated @ 124C		165			205		
126			166			206		
127			167			207		
128			168			208		
129			169			209		
130			170			210		
131			171			211		
132			172			212		
133			173			213		
134			174			214		
135			175			215		
136			176			216		
137			177			217		
138			178			218		
139			179			219		
140			180			220		
141			181			221		
142			182			222		
143			183			223		
144			184			224		
145			185			225		
146			186			226		
147			187			227		
148			188			228		
149			189			229		
150			190			230		
151			191			231		
152			192			232		
153			193			233		
154			194			234		
155			195			235		
156			196			236		
157			197			237		
158			198			238		
159			199			239		
160			200			240		

CELL NO: Zn/AgO #47

TEST NAME: AGSTRQ47

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	29.513	29.971	41	18.917	18.803	81	18.432	18.578
2	27.353	27.448	42	19.145	19.189	82	17.956	18.135
3	27.989	28.413	43	18.681	18.600	83	17.202	17.272
4	28.256	28.468	44	19.142	19.171	84	17.223	17.310
5	28.347	28.484	45	18.852	18.901	85	16.856	16.986
6	29.383	29.498	46	18.801	18.748	86	16.657	16.681
7	30.001	31.079	47	18.351	18.502	87	16.753	16.839
8	30.000	32.507	48	18.477	18.445	88	16.779	16.824
9	30.000	28.653	49	18.783	18.890	89	16.946	16.985
10	30.000	32.710	50	17.898	17.965	90	16.813	16.899
11	30.000	27.842	51	18.415	18.377	91	16.786	16.856
12	30.000	30.175	52	17.927	18.150	92	16.670	16.743
13	30.000	29.809	53	18.039	17.998	93	16.439	16.551
14	30.000	29.552	54	18.469	18.604	94	16.371	16.295
15	29.857	28.978	55	17.846	17.934	95	17.196	17.236
16	29.991	29.997	56	18.508	18.569	96	16.239	16.442
17	28.755	28.941	57	18.612	18.763	97	16.826	16.712
18	28.672	29.010	58	18.668	18.758	98	16.778	16.969
19	27.925	28.078	59	18.808	19.034	99	16.298	16.271
20	26.804	27.051	60	18.596	18.800	100	16.771	16.811
21	26.880	27.156	61	18.783	18.949	101	16.432	16.631
22	25.990	26.237	62	18.214	18.449	102	16.365	16.266
23	25.352	25.642	63	17.831	18.005	103	16.719	16.806
24	24.732	24.791	64	17.619	17.740	104	16.105	16.277
25	23.953	24.023	65	17.445	17.552	105	16.350	16.285
26	23.626	23.677	66	17.541	17.643	106	16.687	16.735
27	22.555	22.628	67	17.313	17.426	107	16.721	16.735
28	22.467	22.472	68	17.578	17.555	108	17.031	17.047
29	21.753	21.873	69	17.764	17.886	109	16.789	16.865
30	21.462	21.520	70	17.443	17.607	110	16.817	16.787
31	19.964	20.496	71	17.679	17.788	111	16.912	17.008
32	20.525	20.519	72	17.648	17.873	112	16.171	16.315
33	19.577	19.485	73	17.515	17.643	113	16.191	16.151
34	19.633	19.542	74	17.323	17.495	114	16.448	16.534
35	19.440	19.430	75	16.900	17.097	115	15.783	15.899
36	18.944	18.845	76	16.773	16.899	116	16.501	16.306
37	19.373	19.328	77	16.534	16.686	117	16.765	16.887
38	19.031	18.984	78	10.368	10.421	118	16.202	16.275
39	19.219	19.170	79	18.773	19.014	119	17.206	17.075
40	18.984	18.934	80	18.957	19.232	120	16.630	16.824

Ave. Cap.1-24 cycles: AH

28.575

28.770

3 MONTH STORAGE @ R/T IN FULLY DISCHARGED STATE

CELL NO: Zn/AgO #47

TEST NAME: AGSTRQ47

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
121	15.965	16.136	161			201		
122	15.469	15.607	162			202		
123	15.373	15.437	163			203		
124	16.096	15.796	164			204		
125	16.746	16.764	165			205		
126	16.886	16.828	166			206		
127	17.204	17.099	167			207		
128	17.030	17.099	168			208		
129	17.082	17.035	169			209		
130	17.032	17.104	170			210		
131	16.401	16.582	171			211		
132	16.276	16.289	172			212		
133	16.326	16.380	173			213		
134	13.714	16.125	174			214		
135	16.482	16.461	175			215		
136	16.272	16.389	176			216		
137	15.480	15.623	177			217		
138	16.031	15.963	178			218		
139	15.883	15.997	179			219		
140	15.252	15.347	180			220		
141	15.610	15.569	181			221		
142	15.345	15.478	182			222		
143			183			223		
144	Terminated @ 143C		184			224		
145			185			225		
146			186			226		
147			187			227		
148			188			228		
149			189			229		
150			190			230		
151			191			231		
152			192			232		
153			193			233		
154			194			234		
155			195			235		
156			196			236		
157			197			237		
158			198			238		
159			199			239		
160			200			240		

CELL NO: Zn/AgO #48			TEST NAME: AGSTR48					
Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.000	37.464	41	22.401	22.471	81	20.234	20.131
2	30.000	30.379	42	22.041	22.030	82	21.605	21.633
3	30.000	29.264	43	22.419	22.650	83	20.005	20.219
4	30.000	30.234	44	22.038	22.058	84	20.889	20.847
5	30.000	29.232	45	22.117	22.357	85	19.821	20.063
6	30.000	29.005	46	22.104	22.145	86	20.660	20.601
7	30.000	27.354	47	22.018	22.341	87	20.102	20.441
8	30.000	28.580	48	21.589	21.697	88	20.575	20.434
9	30.000	34.960	49	24.948	22.242	89	20.390	20.733
10	30.000	27.522	50	24.647	21.751	90	20.120	20.024
11	30.000	28.708	51	22.282	22.528	91	20.538	20.637
12	29.179	28.838	52	21.934	22.050	92	20.642	20.646
13	29.945	30.400	53	22.813	23.044	93	20.760	20.880
14	28.885	29.385	54	22.562	22.809	94	20.548	20.534
15	27.583	28.014	55	22.809	23.108	95	20.789	20.882
16	27.680	28.002	56	22.355	22.667	96	19.288	19.555
17	26.616	26.568	57	22.437	22.755	97	20.408	20.293
18	26.039	26.470	58	21.644	22.017	98	19.680	20.033
19	25.553	25.783	59	21.316	21.612	99	20.180	19.859
20	25.084	25.438	60	21.156	21.373	100	20.727	21.052
21	25.389	25.667	61	21.441	21.680	101	20.215	19.943
22	24.731	25.058	62	21.411	21.550	102	20.912	21.188
23	24.544	24.926	63	22.339	22.512	103	19.341	19.784
24	24.100	24.276	64	21.835	22.133	104	18.577	18.882
25	23.508	23.808	65	22.394	22.605	105	18.805	18.796
26	23.474	23.514	66	21.953	22.255	106	20.842	20.391
27	23.301	23.556	67	21.853	22.228	107	20.697	20.631
28	23.104	23.200	68	21.167	21.534	108	21.853	21.160
29	23.219	23.420	69	21.354	21.534	109	20.828	20.996
30	22.684	22.838	70	19.776	21.315	110	21.256	21.212
31	22.124	22.302	71	23.489	23.642	111	20.344	20.845
32	22.296	22.323	72	23.681	23.929	112	19.620	19.684
33	21.464	21.605	73	22.826	22.878	113	19.851	19.989
34	21.860	21.890	74	22.119	22.361	114	19.950	17.735
35	21.511	21.608	75	21.401	21.442	115	19.890	19.796
36	21.903	21.922	76	21.253	21.397	116	18.850	19.253
37	22.100	22.167	77	21.338	21.365	117	19.321	19.290
38	21.932	21.977	78	21.200	21.302	118	19.032	19.400
39	22.115	22.199	79	20.926	21.022	119	18.327	18.419
40	22.023	22.019	80	20.689	20.873	120	18.834	18.919

Ave. Cap.1-24 cycles: AH
 28.139 28.397
 3 MONTH STORAGE @ 35 °C IN FULLY DISCHARGED STATE

CELL NO: Zn/AgO #48 TEST NAME: AGSTRR48

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
121	17.860	18.175	161			201		
122	18.358	18.342	162			202		
123	18.219	18.328	163			203		
124	18.216	18.313	164			204		
125	17.991	18.165	165			205		
126	18.125	18.136	166			206		
127	18.238	18.332	167			207		
128	17.694	18.021	168			208		
129	17.555	17.582	169			209		
130	17.763	17.896	170			210		
131	17.075	17.277	171			211		
132	17.716	17.683	172			212		
133	17.279	17.544	173			213		
134	17.517	17.149	174			214		
135	17.421	17.538	175			215		
136	10.626 *	16.993	176			216		
137	Terminated @ 136D		177			217		
138			178			218		
139			179			219		
140			180			220		
141			181			221		
142			182			222		
143			183			223		
144			184			224		
145			185			225		
146			186			226		
147			187			227		
148			188			228		
149			189			229		
150			190			230		
151			191			231		
152			192			232		
153			193			233		
154			194			234		
155			195			235		
156			196			236		
157			197			237		
158			198			238		
159			199			239		
160			200			240		

* End of discharge voltage was 0 V.

CELL NO: Zn/AgO #49

TEST NAME: AGSTRR49

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.000	34.872	41	21.807	21.675	81	19.771	19.880
2	30.000	29.451	42	21.543	21.371	82	19.535	19.638
3	30.000	32.194	43	21.999	21.863	83	19.465	19.611
4	30.000	29.470	44	21.676	21.568	84	19.081	19.293
5	30.000	28.605	45	21.902	21.915	85	19.227	19.106
6	30.000	28.783	46	21.436	21.381	86	19.775	20.070
7	30.000	29.925	47	21.633	21.549	87	18.822	18.828
8	30.000	28.563	48	21.068	21.018	88	19.402	19.490
9	30.000	21.303	49	21.547	21.466	89	18.518	18.717
10	30.000	32.685	50	21.084	21.036	90	19.224	19.233
11	30.000	27.661	51	21.809	21.729	91	18.855	19.103
12	30.000	29.169	52	21.262	21.304	92	19.110	18.976
13	30.000	30.206	53	21.681	21.605	93	19.276	19.622
14	29.416	29.039	54	21.863	21.894	94	18.712	18.692
15	28.973	29.023	55	21.984	22.033	95	19.400	19.474
16	28.536	28.463	56	21.862	21.961	96	19.149	19.244
17	27.518	27.532	57	21.781	21.838	97	19.449	19.502
18	27.341	27.297	58	21.460	21.559	98	19.145	19.273
19	26.440	26.395	59	21.133	21.235	99	19.390	19.393
20	25.796	25.790	60	20.891	20.914	100	19.204	19.555
21	25.758	25.712	61	20.812	20.794	101	18.575	18.593
22	25.019	25.052	62	20.754	20.774	102	19.087	19.140
23	24.905	24.933	63	21.799	20.783	103	18.038	18.352
24	24.403	24.314	64	21.305	21.204	104	19.141	18.881
25	23.792	23.846	65	21.077	21.115	105	19.389	19.729
26	23.464	23.281	66	21.383	21.371	106	18.986	18.720
27	23.398	23.364	67	21.197	21.280	107	19.712	19.887
28	23.130	23.019	68	21.212	21.277	108	18.324	18.718
29	23.076	23.080	69	20.712	20.853	109	17.520	17.913
30	22.608	22.521	70	21.548	20.572	110	17.340	17.497
31	22.069	22.037	71	20.416	20.495	111	18.612	18.189
32	22.337	21.548	72	23.875	24.222	112	19.282	19.355
33	21.478	21.401	73	22.920	23.455	113	19.838	19.598
34	21.612	21.429	74	21.990	22.125	114	19.685	19.877
35	21.420	21.350	75	21.152	21.391	115	19.487	19.477
36	21.654	21.440	76	20.724	20.731	116	19.651	19.785
37	21.767	21.618	77	20.223	20.503	117	18.667	19.047
38	21.589	21.459	78	19.637	19.707	118	18.549	18.498
39	21.662	21.540	79	19.697	19.875	119	18.469	18.662
40	21.574	21.357	80	19.628	19.716	120	17.918	16.538

Ave. Cap.1-24 cycles: AH

28.504

28.185

3 MONTH STORAGE @ 35 °C IN FULLY DISCHARGED STATE

CELL NO: Zn/AqO #49

TEST NAME: AGSTR49

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
121	18.429	18.511	161			201		
122	17.647	18.000	162			202		
123	17.751	17.677	163			203		
124	17.891	18.107	164			204		
125	16.967	17.246	165			205		
126	17.503	17.502	166			206		
127	17.057	17.377	167			207		
128	6.157	5.001	168			208		
129	17.614	18.286	169			209		
130	17.365	17.631	170			210		
131	17.061	17.325	171			211		
132	17.793	17.039	172			212		
133	17.578	16.718	173			213		
134	16.801	16.882	174			214		
135	16.626	16.798	175			215		
136	15.656	16.020	176			216		
137	16.161	16.114	177			217		
138	16.013	16.285	178			218		
139	15.446	15.588	179			219		
140	15.988	15.967	180			220		
141	15.781	16.012	181			221		
142	15.084	15.004	182			222		
143	15.644	15.685	183			223		
144	15.514	15.866	184			224		
145	Terminated @ 145C		185			225		
146			186			226		
147			187			227		
148			188			228		
149			189			229		
150			190			230		
151			191			231		
152			192			232		
153			193			233		
154			194			234		
155			195			235		
156			196			236		
157			197			237		
158			198			238		
159			199			239		
160			200			240		

CELL NO: Zn/AqO #50

TEST NAME: AGSTRS50,AGSRS50A

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	13.488		41	13.974	12.947	81	15.722	16.009
2	20.748	16.954	42	13.961	14.022	82	15.639	15.653
3	20.839	18.013	43	14.838	13.830	83	15.430	15.638
4	20.305	20.473	44	13.174	13.372	84	15.304	15.545
5	19.914	20.076	45	18.546	18.589 *	85	15.355	15.427
6	19.212	19.403	46	18.855	19.080	86	15.156	15.319
7	18.924	19.055	47	18.717	18.930	87	14.906	15.069
8	18.512	18.720	48	18.820	18.973	88	14.998	15.124
9	17.992	18.185	49	19.038	18.805	89	15.702	15.149
10	18.030	18.116	50	19.085	19.210	90	14.983	15.127
11	17.492	17.641	51	18.949	19.236	91	14.661	14.850
12	16.915	17.526	52	19.119	19.164	92	14.547	14.819
13	17.418	17.493	53	18.933	19.074	93	14.920	14.876
14	17.164	17.241	54	18.759	18.951	94	14.648	14.795
15	17.078	17.072	55	18.628	18.721	95	14.192	14.544
16	16.941	17.030	56	18.800	17.383	96	13.882	14.079
17	16.626	16.696	57	19.052	18.981	97	14.106	14.116
18	16.597	16.636	58	19.119	19.266	98	14.040	14.188
19	16.129	16.226	59	18.985	19.125	99	13.917	14.066
20	16.072	16.071	60	18.443	18.709	100	13.884	14.101
21	16.194	16.194	61	18.200	18.289	101	Terminated @ 101C	
22	16.018	16.049	62	18.201	18.183	102		
23	16.151	16.111	63	18.275	18.397	103		
24	16.120	16.167	64	18.242	18.372	104		
25	15.908	15.935	65	17.808	18.079	105		
26	15.907	15.919	66	17.475	17.671	106		
27	15.515	15.643	67	17.526	17.687	107		
28	15.183	15.246	68	17.479	17.897	108		
29	15.195	15.179	69	17.514	18.036	109		
30	15.208	15.277	70	17.292	17.942	110		
31	14.940	15.029	71	17.010	17.718	111		
32	14.857	14.859	72	17.055	17.542	112		
33	14.819	14.936	73	16.801	17.006	113		
34	14.499	14.568	74	16.520	16.822	114		
35	14.490	14.468	75	16.430	16.947	115		
36	14.493	14.568	76	16.094	16.731	116		
37	14.241	14.321	77	15.979	16.621	117		
38	14.282	14.262	78	15.836	16.462	118		
39	14.252	14.306	79	15.771	16.206	119		
40	14.078	14.156	80	15.762	16.118	120		

3 MONTH STORAGE @ R/T IN FULLY CHARGED STATE

*45C: Reduced charging rate to C/30. (File Name: AGSRS50A)

CELL NO: Zn/AqO #51

TEST NAME: AGSTRS51, AGSRS51A

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	17.541		41	14.602	14.685	81	17.999	18.100
- 2	21.343	14.490	42	15.066	12.264	82	18.094	18.056
3	21.086	20.096	43	17.557	17.505 *	83	18.128	18.086
4	20.296	20.411	44	19.350	19.411	84	17.941	17.988
5	20.029	20.169	45	19.560	19.763	85	17.555	17.610
6	19.346	19.495	46	19.753	18.817	86	17.397	17.419
7	19.177	19.326	47	20.122	19.104	87	17.540	17.511
8	18.706	18.894	48	20.181	20.170	88	14.446	17.596
9	18.316	18.456	49	20.285	20.237	89	16.951	17.073
10	18.407	18.535	50	20.384	19.770	90	17.443	17.343
11	17.750	17.899	51	20.336	19.485	91	17.547	17.665
12	18.143	18.582	52	20.155	20.311	92	17.574	17.664
13	17.908	18.040	53	20.137	20.202	93	17.082	17.211
14	17.638	17.697	54	20.372	18.817	94	16.880	17.044
15	17.678	17.759	55	20.731	20.631	95	16.839	16.995
16	17.374	17.451	56	20.804	20.882	96	16.683	16.830
17	17.165	17.199	57	20.538	20.762	97	16.596	16.595
18	17.013	17.121	58	20.144	20.257	98	16.553	16.621
19	16.638	16.721	59	20.129	20.086	99	16.463	16.494
20	16.757	16.714	60	20.298	20.311	100	16.239	16.412
21	16.740	16.790	61	20.173	20.208	101	16.192	16.316
22	16.848	16.748	62	19.858	20.034	102	16.160	16.189
23	16.977	17.014	63	19.576	19.700	103	15.954	16.036
24	16.744	16.798	64	19.555	19.610	104	15.820	15.881
25	16.754	16.765	65	19.507	19.482	105	15.821	15.850
26	16.451	16.567	66	19.461	19.499	106	15.829	15.923
27	16.037	16.138	67	19.291	19.425	107	15.803	15.876
28	15.999	15.988	68	19.393	19.284	108	15.674	15.761
29	16.020	16.073	69	19.420	19.442	109	15.323	14.959
30	15.635	15.745	70	19.690	19.331	110	15.088	15.266
31	15.583	15.585	71	18.089	18.276	111	15.180	15.290
32	15.488	15.583	72	18.745	18.804	112	15.054	15.121
33	15.098	15.183	73	18.478	18.625	113	14.861	14.976
34	15.167	15.162	74	18.265	18.383	114	14.760	14.896
35	15.072	15.149	75	18.313	18.387	115	14.863	14.915
36	14.774	14.836	76	18.359	18.441	116	14.789	14.903
37	14.965	14.965	77	18.314	18.290	117	14.689	14.801
38	14.910	14.969	78	18.248	18.276	118	14.650	14.616
39	15.531	14.783	79	18.115	28.175	119	14.544	14.700
40	14.541	14.644	80	17.960	18.090	120	14.638	14.797

Terminated @ 156C

3 MONTH STORAGE @ R/T IN FULLY CHARGED STATE
 *43C: Reduced charging rate to C/30. (File Name: AGSRS51A)

CELL NO: Zn/AgO #52 TEST NAME: AGSTRT52

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	12.764		41	17.800	17.598	81		
2	17.829	18.789	42	17.804	18.028	82		
3	18.769	17.787	43	17.684	17.835	83		
4	18.537	18.739	44	17.414	17.625	84		
5	17.831	18.038	45	17.492	17.563	85		
6	17.494	17.706	46	17.544	17.344	86		
7	16.937	17.151	47	17.620	17.672	87		
8	16.758	16.933	48	17.744	17.704	88		
9	16.135	16.363	49	17.802	17.709	89		
10	15.766	15.921	50	17.651	17.646	90		
11	15.886	16.017	51	17.605	17.618	91		
12	15.477	15.684	52	17.386	17.496	92		
13	13.359	15.463	53	16.528	17.323	93		
14	15.558	13.647	54	17.358	17.515	94		
15	15.458	15.592	55	17.751	17.578	95		
16	15.167	15.289	56	17.835	17.934	96		
17	15.447	15.392	57	17.599	17.804	97		
18	15.301	15.458	58	17.195	17.415	98		
19	14.937	15.089	59	17.056	17.128	99		
20	15.190	15.173	60	17.285	17.106	100		
21	14.882	15.025	61	17.272	17.006	101		
22	14.598	14.704	62	17.222	17.344	102		
23	14.878	14.791	63	16.943	17.158	103		
24	14.793	14.924	64	16.650	16.836	104		
25	14.879	14.822	65	16.622	16.659	105		
26	15.031	15.130	66	16.789	16.856	106		
27	14.885	14.987	67	16.551	16.712	107		
28	14.774	14.843	68	16.188	16.468	108		
29	14.782	14.899	69	16.181	16.310	109		
30	14.453	14.610	70	16.147	16.356	110		
31	14.006	14.150	71	16.112	16.327	111		
32	14.140	14.122	72	Terminated @ 72C			112	
33	14.188	14.328	73				113	
34	13.790	13.975	74				114	
35	13.739	13.667	75				115	
36	13.787	13.932	76				116	
37	13.107	13.613	77				117	
38	17.648	17.436 *	78				118	
39	18.255	18.406	79				119	
40	18.240	18.235	80				120	

3 MONTH STORAGE @ 35 °C IN FULLY CHARGED STATE
 • Reduced charging rate to C/30 @ 38 th charge

CELL NO: Zn/AgO #53

TEST NAME: AGSRT53, AGSRT53A

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	5.162		41	16.037	15.921 *	81	14.942	15.041
2	14.953	14.556	42	17.188	17.168	82	14.618	14.833
3	14.865	15.410	43	17.256	16.392	83	14.502	14.669
4	16.410	16.470	44	17.001	16.634	84	14.250	14.395
5	16.939	17.035	45	16.839	17.034	85	14.222	14.286
6	16.598	16.711	46	16.681	16.812	86	14.208	14.281
7	16.185	16.316	47	16.525	16.660	87	14.080	14.179
8	15.683	15.820	48	16.465	16.490	88	13.939	13.960
9	15.558	15.666	49	16.409	15.574	89	13.985	14.095
10	14.947	15.113	50	16.396	16.424	90	13.970	14.056
11	14.571	14.689	51	16.315	16.389	91	13.840	13.923
12	14.736	14.820	52	15.216	16.395	92	13.676	13.754
13	14.536	14.660	53	16.370	16.333	93	13.693	13.813
14	14.253	14.338	54	16.347	15.969	94	13.755	13.708
15	14.686	15.341	55	16.180	16.232	95	13.845	13.832
16	14.543	14.621	56	15.890	16.054	96	13.762	13.826
17	14.316	14.414	57	15.803	15.944	97	13.787	13.821
18	14.264	14.216	58	15.882	14.208	98	13.486	13.568
19	14.470	14.534	59	16.437	16.149	99	13.357	13.483
20	14.197	14.312	60	16.500	16.606	100	13.715	13.481
21	13.964	13.978	61	16.203	16.354	101	13.657	13.720
22	14.100	14.148	62	15.931	16.156	102	13.558	13.686
23	13.750	13.834	63	15.638	15.846	103	12.901	13.166
24	13.503	13.554	64	15.614	15.688	104	13.310	13.156
25	13.838	13.743	65	15.815	15.727	105	13.714	13.668
26	13.740	13.842	66	15.760	15.239	106	13.842	13.805
27	13.675	13.713	67	15.626	15.737	107	13.899	13.929
28	13.981	13.949	68	15.445	15.616	108		13.712
29	13.837	13.928	69	15.205	15.386	109	Terminated @ 108D	
30	13.675	13.728	70	15.116	15.224	110		
31	13.784	13.769	71	15.041	15.191	111		
32	13.591	13.700	72	2.780	2.683 **	112		
33	13.275	13.413	73	15.835	15.512 **	113		
34	12.924	12.996	74	16.002	16.088	114		
35	13.122	13.131	75	15.393	15.546	115		
36	13.049	13.094	76	15.289	15.393	116		
37	12.548	12.675	77	15.169	15.236	117		
38	12.532	12.523	78	14.983	15.115	118		
39	12.683	12.735	79	0.503	0.683	119		
40	12.498	12.612	80	14.293	13.972	120		

3 MONTH STORAGE @ 35 °C IN FULLY CHARGED STATE

• Reduced charging rate to C/30 @ 41 st charge

**72C & 73C: Data file re-started under same name several times.

CELL NO: Zn/AqO # 54

TEST NAME: AGIII54, AGPST54

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.002	44.397	41			81		
2	30.001	31.294	42			82		
3	30.000	30.074	43			83		
4	30.001 *	29.127	44			84		
5		25.883 **	45			85		
6		30.000 **	46			86		
7		30.003 **	47			87		
8		30.001 **	48			88		
9		30.001 **	49			89		
10		1.587 **	50			90		
11			51			91		
12			52			92		
13			53			93		
14			54			94		
15			55			95		
16			56			96		
17			57			97		
18			58			98		
19			59			99		
20			60			100		
21			61			101		
22			62			102		
23			63			103		
24			64			104		
25			65			105		
26			66			106		
27			67			107		
28			68			108		
29			69			109		
30			70			110		
31			71			111		
32			72			112		
33			73			113		
34			74			114		
35			75			115		
36			76			116		
37			77			117		
38			78			118		
39			79			119		
40			80			120		

3 MONTH STORAGE @ R/T IN FULLY DISCHARGED STATE AFTER 4 CYCLES

*On storage after 4D

**On test after storage.

Station malfunction: cell did not switched to discharge after completed charge.

Total charge capacity = 147.5 Ah. Final voltage was 5.014 V. Cell vented.

CELL NO: Zn/AqO #55

TEST NAME: AGIII55, AGPST55, AGPST55B

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.002	39.422	41	21.088	21.212	81		
2	30.002	31.992	42	20.828	20.880	82		
3	30.001	30.634	43	20.509	20.674	83		
4	30.002 *	29.888	44	20.235	20.293	84		
5	29.594	18.958 **	45	20.522	20.658	85		
6	30.003	25.637	46	20.004	20.068	86		
7	28.770	22.926	47	20.533	20.618	87		
8	19.986	18.487	48	20.159	20.235	88		
9	29.353	29.598	49	20.464	20.548	89		
10	26.586	22.591	50	19.769	19.922	90		
11	26.829	25.448	51	20.179	20.215	91		
12	18.860	20.872	52	19.827	19.972	92		
13	22.335	14.970	53	19.851	19.841	93		
14	21.362	14.320	54	20.136	20.191	94		
15	17.586	17.518	55	19.805	19.819	95		
16	21.089	14.776	56	20.267	20.351	96		
17	20.404	13.015	57	19.732	19.822	97		
18	19.793	24.864	58	20.240	20.332	98		
19	18.165	14.087	59	19.594	19.732	99		
20	20.949	14.279	60	19.858	18.031	100		
21	20.967	15.483	61	19.235	19.442	101		
22	18.056	13.192	62	19.101	19.279	102		
23	19.344	14.376	63	19.216	19.444	103		
24	19.070	14.214	64	18.849	18.974	104		
25	16.848	15.048	65	18.833	18.996	105		
26	15.725	12.841	66	18.457	18.544	106		
27	18.752	14.470	67	18.501	18.570	107		
28	15.406	13.003	68	18.076	18.205	108		
29	18.456	14.378	69	17.736	17.843	109		
30	9.532	14.644	70	17.638	17.736	110		
31	16.754	14.575	71	17.575	17.656	111		
32	29.816	30.037 ***	72	17.392	17.455	112		
33	26.459	26.709 #	73	17.352	17.458	113		
34	24.936	25.133	74	17.156	17.234	114		
35	23.654	23.891	75	17.381	17.432	115		
36	23.466	23.495	76	17.204	17.239	116		
37	22.714	22.884	77	17.244	17.304	117		
38	22.222	22.306	78	17.359	17.459	118		
39	21.749	21.874	79	17.164	17.245	119		
40	21.398	21.460	80		13.367	120		

Ave. Cap.1-11 cycles: AH
28.284 26.871

Terminated @ 80D

3 MONTH STORAGE @ R/T IN FULLY DISCHARGED STATE AFTER 4 CYCLES

*On storage after 4D

** On test after storage

***32 C: Reduced charging rate to C/30.

Charging rate back to C/10.

CELL NO: Zn/AgO #56

TEST NAME: AGIII56, AGPST56, AGPST56A/B/C

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.001	41.087	41	16.092	16.143	81		
2	30.000	33.262	42	16.051	16.082	82		
3	30.002	30.605	43	16.197	16.267	83		
4	30.001 *	30.243	44	15.869	15.926	84		
5	24.899	20.792 **	45	16.067	16.079	85		
6	26.467	26.772	46	15.922	16.003	86		
7	26.412	26.642	47	15.681	15.739	87		
8	25.927	26.232	48	16.145	16.155	88		
9	25.031	25.323	49	15.979	16.048	89		
10	24.676	24.967	50	15.862	15.903	90		
11	23.384	23.603	51	16.317	16.363	91		
12	22.771	22.971	52	13.231	16.288	92		
13	22.084	22.309	53	13.233	16.282	93		
14	22.133	22.362	54	13.507	16.554	94		
15	21.556	21.774	55	13.121	16.184	95		
16	21.998	22.293	56	13.491	16.497	96		
17	21.296	21.522	57	13.720	16.772	97		
18	21.405	21.655	58	13.475	16.543	98		
19	20.812	21.034	59	16.803	16.841	99		
20	20.747	20.984	60	16.658	16.714	100		
21	20.124	20.337	61	16.447	16.503	101		
22	19.440	19.607	62	16.850	16.884	102		
23	19.182	19.373	63	16.570	16.656	103		
24	18.680	18.827	64	16.559	16.608	104		
25	19.937	20.106	65	16.584	16.642	105		
26	10.331 ***	19.649	66	16.321	16.396	106		
27	19.885	10.886	67	23.546	22.828 !!	107		
28	19.837	20.163	68	24.238	24.304	108		
29	18.671	19.936	69	24.368	24.530	109		
30	18.438	18.533	70	24.328	24.467	110		
31	17.858	18.750	71	11.589 !!!	24.430	111		
32	17.612	17.754	72	25.043	12.313 #	112		
33	17.244	17.364	73	24.961	25.113	113		
34	17.037	17.129	74	7.557	7.534	114		
35	16.760	16.875	75	23.873	24.070	115		
36	16.169	16.251	76	28.133	43.288 #	116		
37	16.548	16.605	77	30.000	34.747 #	117		
38	16.399	16.452	78	30.001	29.441	118		
39	16.241	16.311	79	Terminated @ 79C		119		
40	16.345	16.413	80			120		

Ave. Cap.1-10 cycles: AH
27.342 28.592

3 MONTH STORAGE @ 35 °C IN FULLY DISCHARGED STATE AFTER 4 CYCLES

*On storage after 4D

**On test after storage

!!! End of discharge voltage = 0.179V

Noisy voltage. Some < 1.0V

*** 26D: End voltage = 0 V.

!! Reduced charging rate to C/30

CELL NO: Zn/AqO #57

TEST NAME: AGIII57, AGPST57, AGPST57A

Cycle No	Discharge (Ah)	Charge (Ah)	Cycle No	Discharge (Ah)	Charge (Ah)	Cycle No	Discharge (Ah)	Charge (Ah)
1	30.002	44.005	41	18.517	18.705	81	15.367	15.485
2	30.002	30.884	42	18.344	18.527	82	15.411	15.431
3	30.001	29.654	43	18.096	18.186	83	16.047	16.141
4	30.001 *	29.098	44	18.142	18.190	84	16.096	16.208
5	28.301	22.726 **	45	17.707	17.723	85	16.395	16.455
6	30.001	30.229	46	17.665	17.786	86	16.190	16.436
7	29.587	29.607	47	17.557	17.709	87	16.118	16.157
8	28.843	28.954	48	17.735	17.791	88	16.339	16.436
9	27.494	27.576	49	17.629	17.791	89	16.042	16.275
10	26.812	26.940	50	17.569	17.691	90	15.565	15.864
11	25.712	25.821	51	17.452	17.580	91	15.431	15.668
12	25.080	25.175	52	17.314	17.428	92	15.990	16.170
13	25.016	25.139	53	17.027	17.137	93	15.659	15.938
14	24.182	24.269	54	17.820	17.958	94	15.218	15.414
15	24.659	24.786	55	16.925	17.073	95	15.724	15.917
16	23.635	23.728	56	17.411	17.455	96	15.652	15.797
17	24.063	24.195	57	17.328	17.472	97	15.058	15.211
18	23.140	23.240	58	16.846	16.950	98	15.301	15.524
19	22.815	22.930	59	17.321	17.330	99	15.128	15.410
20	22.243	22.334	60	16.885	17.046	100	14.797	14.930
21	22.199	22.326	61	16.894	17.079	101	14.983	15.121
22	21.824	21.927	62	17.129	17.206	102	14.915	15.081
23	21.944	22.119	63	16.481	16.576	103	14.958	15.067
24	21.656	21.700	64	17.004	17.087	104	14.851	15.081
25	21.302	21.557	65	16.868	16.983	105	14.828	14.888
26	20.929	21.021	66	17.005	17.064	106	14.925	14.970
27	21.619	20.110	67	17.065	17.194	107	14.860	14.987
28	20.876	21.139	68	16.886	17.006	108	14.609	14.818
29	21.205	21.232	69	16.915	17.078	109	14.000	14.145
30	21.021	21.128	70	16.903	17.036	110	14.478	14.511
31	20.345	20.437	71	16.089	16.228	111		
32	20.161	20.410	72	16.652	16.767	112	Terminated @ 169C	
33	20.618	20.659	73	16.394	16.660	113		
34	20.158	20.324	74	16.174	16.247	114		
35	20.328	20.474	75	16.935	17.062	115		
36	19.769	20.014	76	16.685	16.818	116		
37	8.200	8.272	77	16.419	16.579	117		
38	18.107	18.214	78	16.891	17.060	118		
39	18.943	19.276	79	15.968	16.212	119		
40	18.537	18.581	80	15.683	15.835	120		

Ave. Cap.1 – 15 cycles: AH

27.713 28.324

3 MONTH STORAGE @ 35 °C IN FULLY DISCHARGED STATE AFTER 4 CYCLES

*On storage after 4D

**On test after storage

CELL NO: Zn/AqO #58

TEST NAME: AGPIIN58, APIIN58A

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	27.788	28.088	41			81		
2	28.330	28.490	42			82		
3	30.000	32.597	43			83		
4	30.000	32.512	44			84		
5	30.000	29.342	45			85		
6	30.001	30.409	46			86		
7	30.001	28.195	47			87		
8	29.350	27.971	48			88		
9	30.001	34.195	49			89		
10	30.001	30.728	50			90		
11	30.001	28.701	51			91		
12	28.452	26.240	52			92		
13	18.722	20.524	53			93		
14	18.215	18.786	54			94		
15	17.478	17.534	55			95		
16	16.784	16.988	56			96		
17	16.165	16.331	57			97		
18	15.893	15.951	58			98		
19	15.485	15.557	59			99		
20	15.115	15.221	60			100		
21	14.762	14.925	61			101		
22	14.453	14.633	62			102		
23	14.237	14.507	63			103		
24	19.854	18.276 *	64			104		
25	21.087	21.241	65			105		
26	21.540	21.649	66			106		
27	20.987	21.815	67			107		
28	20.820	21.080	68			108		
29	20.007	20.888	69			109		
30	19.611	20.049	70			110		
31	19.483	19.734	71			111		
32	0.001	19.440	72			112		
33	Cell shorted @ 32D		73			113		
34			74			114		
35			75			115		
36			76			116		
37			77			117		
38			78			118		
39			79			119		
40			80			120		

Ave. Cap.1-12 cycles: AH

29.494 29.789

C/10 CHARGING RATE @ -2 °C

*24 C: Reduced charging rate to C/30.(File Name: APIIN58A)

CELL NO: Zn/AqO #59

TEST NAME: AGPIIN59

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	29.847	30.112	41	13.480	13.547	81		
2	28.531	28.765	42	13.501	13.744	82		
3	30.001	33.982	43	13.378	13.468	83		
4	30.001	32.595	44	13.242	13.411	84		
5	30.000	29.513	45	13.467	13.634	85		
6	30.000	29.411	46	13.273	13.353	86		
7	30.000	30.239	47	13.170	13.371	87		
8	30.001	26.268	48	13.456	13.257	88		
9	30.001	34.983	49	12.979	13.388	89		
10	30.000	31.597	50	12.990	13.132	90		
11	30.000	27.290	51	6.343	13.075	91		
12	28.357	27.310	52	Cell shorted @ 51D		92		
13	21.291	22.291	53			93		
14	20.223	20.547	54			94		
15	19.237	19.431	55			95		
16	18.356	18.549	56			96		
17	17.762	17.862	57			97		
18	17.099	17.271	58			98		
19	16.677	16.765	59			99		
20	16.322	16.523	60			100		
21	15.991	16.215	61			101		
22	15.702	15.918	62			102		
23	15.330	15.483	63			103		
24	15.069	15.224	64			104		
25	15.082	15.335	65			105		
26	14.812	14.896	66			106		
27	14.642	14.808	67			107		
28	14.742	14.920	68			108		
29	14.454	14.542	69			109		
30	14.308	14.519	70			110		
31	14.509	14.330	71			111		
32	13.945	14.372	72			112		
33	14.003	14.134	73			113		
34	13.800	14.041	74			114		
35	14.034	14.172	75			115		
36	13.758	13.912	76			116		
37	13.703	13.801	77			117		
38	14.020	13.892	78			118		
39	13.493	13.907	79			119		
40	13.469	13.629	80			120		

Ave. Cap.1-12 cycles: AH

29.728 30.172

C/10 CHARGING RATE @ -2 °C

CELL NO: Zn/AqO #60

TEST NAME: AGPIIP60

Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)	Cycle No	Discharge (AH)	Charge (AH)
1	30.001	41.909	41	4.930	4.820	81		
2	30.000	31.711	42	4.778	4.701	82		
3	30.001	30.491	43	4.684 *	4.583	83		
4	30.001	29.814	44	4.554 *	4.483 *	84		
5	30.001	29.622	45	4.409 *	4.372	85		
6	30.000	29.229	46	4.306 *	4.256	86		
7	30.001	29.424	47	4.255 *	4.176 *	87		
8	30.001	29.810	48	4.159 *	4.138	88		
9	30.001	28.826	49	4.047 *	4.042 *	89		
10	30.000	29.340	50	4.005 *	3.957 *	90		
11	30.000	29.707	51			91		
12	30.000	28.633	52	Terminated @ 199D		92		
13	30.000	28.926	53			93		
14	30.000	30.022	54			94		
15	30.000	29.396	55			95		
16	30.000	30.006	56			96		
17	30.000	30.149	57			97		
18	30.001	29.099	58			98		
19	27.601	27.730	59			99		
20	27.971	26.054	60			100		
21	27.955	28.149	61			101		
22	28.524	28.699	62			102		
23	28.399	28.407	63			103		
24	27.787	27.952	64			104		
25	27.275	27.480	65			105		
26	26.468	26.539	66			106		
27	25.901	26.062	67			107		
28	25.269	25.346	68			108		
29	24.836	24.930	69			109		
30	24.587	24.707	70			110		
31	24.005	24.142	71			111		
32	24.370	24.225	72			112		
33	23.370	23.456	73			113		
34	23.564	23.741	74			114		
35	22.133	22.696	75			115		
36	6.082	5.234	76			116		
37	22.276	22.676	77			117		
38	5.679	5.324	78			118		
39	4.895	5.234	79			119		
40	5.087	4.948	80			120		
Ave. Cap.1-32 cycles: AH 28.467 28.642 C/10 CHARGING RATE @ R/T * Noisy voltage 43D-199D								

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