Lucent Technologies
Bell Labs Innovations

Unigy® II Batteries
WP-93379

Product Manual
Select Code 157-622-030
Comcode 107728016
Issue 4
March 2000

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Notice:
Every effort was made to ensure that the information in this document was complete and accurate at the time of printing. However, information is subject to change.

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1 Introduction

Unigy® II Batteries

This product manual (Select Code 157-622-030) provides information on Lucent Technologies' Unigy® II batteries. The Unigy® II battery is a stationary, valve-regulated, rechargeable, lead-acid battery backed by Bell Laboratories, an acknowledged leader in technology, research, and design of power systems.

Lucent Technologies power products have proven their field reliability by providing dependable standby reserve power for the telecommunications industry for decades. All battery components and the manufacturing processes meet Lucent Technologies' strict specifications and quality standards.

Designed for applications where loads are large, temperatures are controlled, and long backup time is desired, Unigy® II batteries are an excellent choice for huts and controlled environment vaults (CEVs), remote switching offices, small- to medium-sized central offices, and customer premise applications.

Figure 1-1 is a cut-away view of a Unigy® II battery.

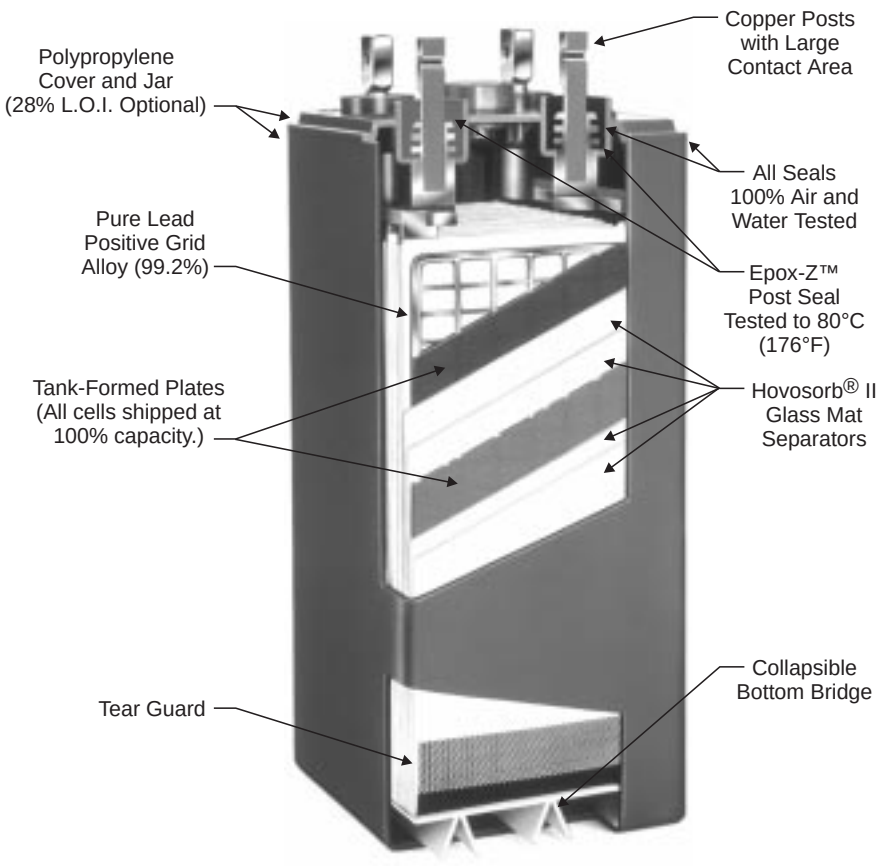


Figure 1-1: Unigy® II Battery

Customer Assistance Contacts

Customer Training

Lucent Technologies offers customer training on many Power Systems products. For information call 1-972-284-2163. This number is answered from 8:00 a.m. until 4:30 p.m., Central Time Zone (Zone 6), Monday through Friday.

Customer Service

For customers in the United States, Canada, Puerto Rico, and the US Virgin Islands, call 1-800-THE-1PWR (1-800-843-1797). Services provided through this contact include initiating the spare parts procurement process for out of service emergencies, ordering Lucent Technologies documents, and providing other product and service information.

For other customers worldwide, call 001-972-840-0382. This number is answered from 8:00 a.m. until 4:30 p.m., Central Time Zone (Zone 6), Monday through Friday.

Technical Support

Technical support for Lucent Technologies customers is available around the world during the normal product warranty period and also while specific contractual agreements extend this service.

For customers in the United States, Canada, Puerto Rico, and the US Virgin Islands, call 1-800-CAL-RTAC (1-800-225-7822) to contact a product specialist to answer your technical questions and assist in troubleshooting problems.

For other customers worldwide, contact your local field support center or your sales representative to discuss your specific needs.

Product Repair and Return

Repair and return service is provided for Lucent Technologies customers around the world.

For customers in the United States, Canada, Puerto Rico, and the US Virgin Islands, call 1-800-255-1402 for information on returning of products for repair.

For other customers worldwide, contact your sales representative to discuss your particular circumstances.

Warranty Service

For domestic warranty service, contact your Warranty Service Manager (WSM). For international warranty service, contact your sales representative.

On-Line Power Systems Product Manuals

For Lucent Technologies users logging in from inside the corporate firewall, the address of the "Power Systems On-Line Product Manuals" page is *http://www.cic.lucent.com/lineage.html*.

For customers logging in from outside the firewall, the address is *http://www.lucent8.com/lineage.html*. The annual subscription fee for access to this site is $25. To obtain a password, follow the instructions on-line or call 1-888-Lucent8 (1-888-582-3688). When prompted for an order number, enter or say "167-790-010."

2 Product Description

Overview

Unigy® II batteries are the solution for quality, valve-regulated rechargeable stationary lead-acid batteries reserve requirements from 160Ah to 4200Ah at the 8-hour rate.

The Unigy® II batteries consist of free-standing modules stacked and assembled in various configurations to meet varying site requirements. Standard modules contain 1, 3, or 6 two-volt cells with each cell containing from 5-33 positive and negative plates of 75 or 85Ah capacity. The module space between cells for heat dissipation provides consistent operation over the life of the battery.

The Unigy® II battery occupies a slightly larger footprint than others in the market due to its innovative design for greater thermal and age management over its life. This size impact is seen primarily in the module design and the depth of the battery jars. The unique module design ensures spacing between battery cells to aid in heat dissipation, without which battery life and performance is reduced. When multiple modules are assembled together, the sturdy module construction provides the benefits of a solid battery stand that passes Zone 4 seismic testing.

A primary feature of Lucent Technologies Unigy® II batteries is the valve-regulated design and construction that prevents electrolyte leakage and minimizes water loss and maintenance throughout the design life. During normal operation, oxygen is generated at the positive electrode and hydrogen is generated at the negative electrode. In conventional (flooded) lead-acid cells, these electrochemical reactions result in water loss from the electrolyte. The self-resealing pressure release safety valves in Unigy® II batteries are designed to aid in the electrochemical recombination of nearly all the oxygen within the battery. In addition, the safety valves prevent the build-up of excessive internal pressure.

The Unigy® II batteries comply with the requirement for sealed battery/cell pressure release test of UL924, Standard for Emergency Lighting and Power Equipment, and UL1989, Standard for Standby Batteries.

Construction

Container and Cover

The standard cell case and cover material is impact resistant polypropylene. Also available are an optional case and cover that are constructed of flame retardant, UL94 V-0/28% Low Oxygen Index (L.O.I.) polypropylene.

Grids

Primarily made of pure lead, the grids exhibit slow growth and provide easy reclamation of spent batteries. The increased depth of the battery jars accommodates the minimal grid expansion as it occurs. An exclusive collapsible bridge under the plates provides room for the plates to grow without harm to battery post and jar-to-cover seals. Tank formation of plates ensures uniform voltages of all cells.

The positive grid is 99.2% pure lead, 0.8% tin; the negative grid is lead calcium.

Posts

The cell terminals are solid copper with lead plating, and are designed for maximum conductivity. Cells with up to 15 plates have two posts, cells with 17 to 27 plates have four posts, and cells with 29 to 33 plates have six posts.

Post Seals

The redesigned and recently automated epoxy post seal uses new Epox-z™ material, which has been tested to 176°F (80°C) to ensure seal integrity. The epoxy around the post seals is color-coded for positive and negative to aid proper installation.

Separators

The separators are microporous glass mats.

Intercell Connectors

The intercell connectors are tin-plated solid copper.

Safety Vent Each 2-volt cell contains a pressure-regulating vent located in the jar cover. The low pressure, self-sealing vent is covered with a porous plastic disk that acts as a flame arrestor. The flame arrestor prevents sparks from entering the battery cell. In multi-cell configurations, the vents and flame arrestors are hidden from view by the bus bar cover.

Safety Shields The flame-retardant, clear plexiglass shields protect the terminal posts and terminal plate assembly from shorting.

Specifications

Table 2-A: Specifications for Unigy® II Batteries

Life	20 Years in Float Applications at 77°F (25°C)
Float Voltage	2.25 ± 1% Volts per Cell (Temperature Compensated)
Self-Discharge	<2% Per Month at 77°F (25°C)
Voltage Stabilization	Occurs within days after initial float charge
Cell Performance	100% of rated capacity at shipment
Recombination Efficiency	Greater than 99%

3 Ordering Information

Battery Modules

Unigy® II battery modules are listed in Table 3-A.

Table 3-A: Unigy® II Battery Modules Ordering Information

Module*	-28 LOI Comcode	Standard Comcode	Voltage and Capacity (8-hr Rate)	Width in. (mm) "W"	Height in. (mm) "H"	Depth in. (mm) "D"	Weight lb. (kg)
6A-75-5†	407586486		12 V, 160 Ah	20.19 (512.8)	8.50 (215.9)	24.5 (622.3)	259 (117.48)
6A-75-7†	407586494		12 V, 235 Ah	24.62 (625.4)	8.50 (215.9)	24.5 (622.3)	330 (149.69)
6A-75-9	407531979	407531961	12 V, 310 Ah	29.12 (739.7)	8.50 (215.9)	24.5 (622.3)	397 (180.08)
6A-75-11	407531938	407531920	12 V, 390 Ah	33.62 (853.9)	8.50 (215.9)	24.5 (622.3)	471 (213.65)
6A-75-13	407586502	407586387	12 V, 470 Ah	38.12 (968.3)	8.50 (215.9)	24.5 (622.3)	542 (245.85)
6A-75-15	407531995	407531987	12 V, 550 Ah	42.62 (1082.6)	8.56 (217.5)	24.5 (622.3)	612 (277.60)
3A-75-17	407531862	407531854	6 V, 630 Ah	27.62 (701.6)	8.56 (217.5)	24.5 (622.3)	382 (173.28)
3A-75-19	407532027	407532019	6 V, 705 Ah	29.88 (758.9)	8.56 (217.5)	24.5 (622.3)	420 (190.51)
3A-75-21	407532043	407532035	6 V, 785 Ah	32.10 (815.8)	8.56 (217.5)	24.5 (622.3)	458 (207.75)
3A-75-23	407531888	407531870	6 V, 865 Ah	34.38 (873.3)	8.56 (217.5)	24.5 (622.3)	496 (224.99)
3A-75-25	407532068	407532050	6 V, 945 Ah	36.62 (930.2)	8.56 (217.5)	24.5 (622.3)	530 (240.41)
3A-75-27	407531912	407531904	6 V. 1025 Ah	38.88 (987.6)	8.56 (217.5)	24.5 (622.3)	568 (257.65)
3A-75-29	407532084	407532076	6 V, 1100 Ah	41.12 (1044.5)	8.56 (217.5)	24.5 (622.3)	606 (274.88)

Table 3-A: Unigy® II Battery Modules Ordering Information

Module*	-28 LOI Comcode	Standard Comcode	Voltage and Capacity (8-hr Rate)	Width in. (mm) "W"	Height in. (mm) "H"	Depth in. (mm) "D"	Weight lb. (kg)
3A-75-31	407532100	407532092	6 V, 1175 Ah	43.38 (1101.9)	8.56 (217.5)	24.5 (622.3)	634 (287.58)
3A-75-33	407532126	407532118	6 V, 1255 Ah	45.62 (1158.8)	8.56 (217.5)	24.5 (622.3)	681 (308.90)
6A-85-7†	407586411	407586429	12 V, 265 Ah	24.62 (625.4)	8.50 (215.9)	27.12 (688.9)	357 (161.94)
6A-85-9	407586437	407586445	12 V, 350 Ah	29.12 (739.7)	8.50 (215.9)	27.12 (688.9)	439 (199.13)
6A-85-11	407586452	407586403	12 V, 440 Ah	33.62 (853.9)	8.50 (215.9)	27.12 (688.9)	521 (236.33)
6A-85-13	407586460	407531342	12 V, 530 Ah	38.12 (968.3)	8.50 (215.9)	27.12 (688.9)	603 (273.52)
6A-85-15	407586478		12 V, 615 Ah	42.62 (1082.6)	8.56 (217.5)	27.12 (688.9)	682 (309.36)
3A-85-17	407531367	407531359	6 V, 695 Ah	27.62 (701.6)	8.56 (217.5)	27.12 (688.9)	428 (194.14)
3A-85-19	407586577		6 V, 785 Ah	29.88 (758.9)	8.56 (217.5)	27.12 (688.9)	472 (214.10)
3A-85-21	407586585		6 V, 875 Ah	32.10 (815.8)	8.56 (217.5)	27.12 (688.9)	508 (230.43)
3A-85-23	407531383	407531375	6 V, 960 Ah	34.38 (873.3)	8.56 (217.5)	27.12 (688.9)	557 (252.66)
3A-85-25	407531409	407531391	6 V, 1050 Ah	36.62 (930.2)	8.56 (217.5)	27.12 (688.9)	598 (271.25)
3A-85-27	407531425	407531417	6 V, 1135 Ah	38.88 (987.6)	8.56 (217.5)	27.12 (688.9)	639 (289.85)
3A-85-29	407586593	407586395	6 V, 1225 Ah	41.12 (1044.5)	8.56 (217.5)	27.12 (688.9)	683 (309.81)
3A-85-31	407531441	407531433	6 V, 1310 Ah	43.38 (1101.9)	8.56 (217.5)	27.12 (688.9)	724 (328.41)
3A-85-33	407531474	407531466	6 V, 1400 Ah	45.62 (1158.8)	8.56 (217.5)	27.12 (688.9)	770 (349.27)
1A-85-39†	407531508	407531490	2 V, 1585 Ah	23.12 (587.2)	8.56 (217.5)	27.12 (688.9)	320 (145.15)
1A-85-45†	407531524	407531516	2 V, 1845 Ah	25.38 (644.7)	8.56 (217.5)	27.12 (688.9)	375 (170.10)
1A-85-51	407531953	407531946	2 V, 2095 Ah	27.62 (701.6)	8.56 (217.5)	27.12 (688.9)	428 (194.14)
1A-85-57	407531565	407531557	2 V, 2360 Ah	29.88 (758.9)	8.56 (217.5)	27.12 (688.9)	472 (214.10)
1A-85-63	407531581	407531573	2 V, 2625 Ah	32.12 (815.9)	8.56 (217.5)	27.12 (688.9)	508 (230.43)
1A-85-69	407531607	407531599	2 V, 2890 Ah	34.38 (873.3)	8.56 (217.5)	27.12 (688.9)	598 (271.25)
1A-85-75	407531623	407531615	2 V, 3145 Ah	36.62 (930.2)	8.56 (217.5)	27.12 (688.9)	557 (252.66)

Table 3-A: Unigy® II Battery Modules Ordering Information

Module*	-28 LOI Comcode	Standard Comcode	Voltage and Capacity (8-hr Rate)	Width in. (mm) "W"	Height in. (mm) "H"	Depth in. (mm) "D"	Weight lb. (kg)
1A-85-81	407531649	407531631	2 V, 3405 Ah	38.88 (987.6)	8.56 (217.5)	27.12 (688.9)	639 (289.85)
1A-85-87	407531805	407531797	2 V, 3675 Ah	41.12 (1044.5)	8.56 (217.5)	27.12 (688.9)	683 (309.81)
1A-85-93	407531821	407531813	2 V, 3935 Ah	43.38 (1101.9)	8.56 (217.5)	27.12 (688.9)	724 (328.41)
1A-85-99	407531847	407531839	2 V, 4200 Ah	45.62 (1158.8)	8.56 (217.5)	27.12 (688.9)	770 (349.27)

* Add the suffix -28 to specify Low Oxygen Index 28%.

† Top-mount framework is 26 in. wide and will overhang these modules.

Note: The model number is broken down as follows: In the model 6A-75-15-28,

6 = voltage code (1 = 2 V, 3 cells in parallel; 3 = 6 V, 3 cells in series; 6 = 12 V, 6 cells in series)

-75 = the plate type (75 Ah or 85 Ah)

-15 = the number of plates per cell

-28 = Low Oxygen Index (LOI) case material

Sample Order

When placing orders for Unigy® II batteries, it is important to specify number and type of modules, string voltage, string configuration, and post configuration in the notes section of the order. For example:

Qty.	Description
12	Comcode 407531862 3A-75-17L Unigy® II batteries Arranged in three +24V strings 4 high, 3 wide side terminal plates

4 Safety and Environmental

Safety Symbols

Safety Precautions

Read the following safety precautions carefully before attempting to handle, unpack, and install the batteries. Fully brief everyone with access to battery areas, or who are working near or with batteries, on the hazards associated with lead-acid batteries. Additional information can be found in the Material Safety Data Sheet (MSDS) in Section 11 of this product manual.

Poison

POISON

CAUSES SEVERE BURNS

Valve-regulated batteries contain toxic materials (lead, lead compounds, and sulfuric acid). Do not incinerate or mutilate. Avoid contact with skin, eyes, or clothing. Recycle batteries in approved reclamation centers according to local, state, and federal regulations.

All lead-acid batteries contain electrolyte (sulfuric acid and water), a highly corrosive substance. Lucent Technologies valve-regulated batteries are designed so that the electrolyte is absorbed by the plates and separators. Electrolyte ordinarily should not leak outside the battery container. However, it is possible that certain types of physical damage and/or abusive charging may force small quantities of electrolyte outside the battery container.

Lucent Technologies valve-regulated batteries are safe; however, accidents can occur.

- When handling batteries or cells, wear protective equipment (e.g., acid resistant rubber gloves, acid resistant rubber aprons, and impact-resistant, splash-proof goggles or full face mask).

- Even when not handling batteries, wear splash-proof and impact-resistant goggles while working around batteries or on equipment containing batteries.

The MSDS in Section 11 contains information that everyone needs to understand before having access to the batteries, such as: health hazard summary, first aid procedures, fire and explosion hazard data, reactivity data, special protection information, environmental information (spill clean-up and disposal), and special precautions.

The following items can be ordered from Lucent Technologies. These items should be available to anyone working around batteries. The local, state, or federal codes for certain installations may require some of these items to be installed and/or kept at the installation site.

- Protective gear

- Acid spill clean-up and management kits

- Battery cleaning and maintenance kits

Electrical Hazard

WARNING

ELECTRICAL HAZARD

In addition to proper job training and safety procedures, the following are some basic precautions that should always be followed when working with or around batteries (including equipment connected to batteries):

- Always use insulated tools.
- Never place uninsulated metal objects on top of a battery.
- Remove all metal jewelry such as rings, watches, bracelets, long necklaces, and any other metallic items.
- Do not short circuit the battery.
- Insure proper polarity when making connections.
- Wear eye protection.

Batteries differ from other sources of power in that they are delivered to the points of installation as live units. A battery gives no indication by its appearance of the potential energy stored in it. Batteries have enormous short circuit capability that can result in serious burns or create dangerous projectiles from the object causing the short circuit.

- Exercise extreme care to avoid any short circuits across the battery terminals.
- In a grounded battery system, use extreme care not to short any metal objects from the ungrounded battery terminal to ground (which can include the equipment metal chassis, building structure, cable racks, etc.).
- Even a single battery poses a potentially high energy hazard if shorted. Shorting a battery may result in explosion of the battery, injury to personnel, and damage to equipment. A tool or other metal object causing the short may be thrown or vaporized due to the energy produced by the battery or system.

A single battery is typically at low voltage; however, batteries connected together in a system can pose a shock hazard in addition to an energy

hazard. When interconnection of the batteries creates a hazardous voltage supply, post appropriate warnings in the end systems or installations. All systems and/or installations should consider the need for additional markings based on the use of the battery, industry standards, and local, state, and federal regulations.

Battery Gases

DANGER

RISK OF EXPLOSION

- Battery gases can be highly explosive. NO sparks, including sparks generated by electrostatic discharge (ESD), or open flame are allowed near battery modules. Do not smoke around batteries. Make sure the battery area is properly ventilated before performing any work.
- Do not place batteries in a sealed enclosure. Even enclosures with ventilation need to be properly evaluated to assure hydrogen will not accumulate to explosive levels.

Valve-regulated batteries are designed to minimize the amount of oxygen and hydrogen gas released from the battery under normal conditions. However, abnormal conditions, such as high temperature, abnormal charging, shorted cells, etc., can produce greater amounts of gas. Even batteries under open circuit conditions can produce gas. If not permitted to escape, this gas can build up to explosive concentrations. Refer to Section 7, *Operation*, for more information on gassing rates.

- ALWAYS place batteries in a well-ventilated area.
- NEVER place batteries in a sealed enclosure.
- Make sure the area is properly ventilated before performing any work.
- Since gas generated by batteries is explosive, avoid creating sparks (including those from static electricity), the use of an open flame, or smoking near the batteries.
- Before performing any work operation, follow proper ESD protection procedures to discharge the static electricity from your body.

- Never tamper with or block the vent caps of batteries. Damaged or clogged vent caps may result in an explosion due to excessive internal pressure. Such an explosion could short circuit other battery modules, result in a fire, injure personnel, or cause damage to equipment.

- Never charge a battery that is visibly damaged or frozen (typically at temperatures less than -40°C or -40°F).

- Be alert to procedures that may create potential hazards, such as creating sparks next to the batteries. Some examples:

  – Avoid disconnecting the circuit at the battery terminals while the battery is being discharged or charged.

  – Avoid making connections at the battery terminal with the other end connected to a load or charging system (unless the circuit has been verified to be open).

  – If there are no devices for opening the circuit before disconnecting or connecting the battery, here are some suggested procedures:

    - Make sure the free end of any wire connected to the batteries is insulated until it is ready to be connected to the load or charger or immediately after being disconnected from the load or charger.

    - Connect to the battery terminals first before connecting to the load or charging system.

    - Disconnect at the load or charger first before disconnecting at the battery terminals.

Freshly charged batteries may produce explosive gas.

- Avoid handling a freshly charged battery within 24 hours after removing the charge. If it must be handled, use extreme caution and avoid any sparks or touching the battery in the area of the vents.

To direct attention to the possible source of danger from battery gases, post one or more warning signs, lettered in large characters, in a conspicuous location near the batteries.

First Aid

Refer to the MSDS in Section 11 for first aid procedures.

Lifting Information

Refer to “Unpacking and Handling” in the Installation section of this product manual for specific handling instructions.

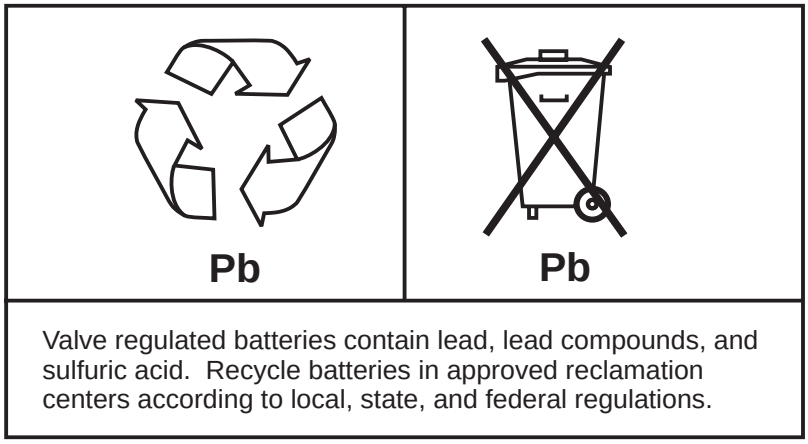
Transportation and Handling

New batteries are shipped meeting United Nations standard, DOT, IATA, IMDG, and other State and Government regulations.

Old/used batteries should be considered as Hazardous Waste and transported according to respective DOT, EPA, OSHA, and other governing regulations or guidelines for Hazardous Waste.

Environmental

Do not discard batteries in trash cans.



5 Battery Storage

State of New Battery

The Unigy® II Battery is shipped in the charged state. The open circuit voltage for a fully charged battery is approximately 2.15V/cell.

Storage Conditions

- Store batteries in a dry and cool environment without exposure to direct sunlight.
- Provide adequate ventilation during storage.
- Do not stack pallets of batteries on top of each other during storage.

Storage Time

Batteries may suffer irreversible capacity loss during long open circuit stand. The maximum that a charged battery may remain on open circuit is 6 months at 77°F. The open circuit time should not exceed 4 months if the storage temperature exceeds 90°F. The “charge by” date stamped on the shipping container is the date the battery has been on open circuit for 6 months. If batteries cannot be installed within this time period, follow the procedures outlined in Table 6-A, “Initial Charging,” and record the actions taken until normal installation can be initiated.

6 Installation

Introduction

This section describes the procedures for installing the Unigy® II batteries. Please review the safety precautions in Section 4 before handling the batteries.

Installation Tools, Materials, and Test Equipment

The following tools, materials, and test equipment are recommended for installation, operation, maintenance, and testing of the batteries:

- Chemical and impact resistant safety goggles and safety hard hat
- Acid resistant gloves, rubber overshoes, and apron
- Lime and/or soda (sodium bicarbonate or sal soda)
- Class C fire extinguisher
- Cleaning cloth
- Insulated socket and a torque wrench capable of measuring 100 inch pounds
- Insulated socket and a torque wrench capable of measuring 25 foot pounds
- Insulated nut driver
- Combination wrench set, screwdrivers
- Sandpaper or abrasive cloth
- Thermocouple-based or infrared-based temperature measuring device
- Digital multimeter (DMM) with an accuracy of 0.05 percent on the dc scale
- DC power source capable of supplying a minimum of 2.5V times the number of 2V modules in a string, or 7.5V times the number of 6V modules in a string, or 15V times the number of 12V modules in a string
- Forklift, hoist, or portable crane

Accessory Package

- Schematic
- Lifting straps
- Installation hardware
- NO-OX ID A®

Product Manual

One product manual is included with each pallet of batteries. Order additional product manuals by calling Customer Service at 1-800-THE-1PWR (1-800-843-1797). Specify Select Code 157-622-030.

Unpacking and Handling

Use appropriate material handling equipment to ensure personnel safety and equipment protection while installing the batteries. Move crated batteries to a convenient predetermined area where the appropriate unpacking and handling equipment and tools are available.

Safe Handling

Use proper equipment when lifting batteries, such as a forklift, hoist, or portable crane. Always check the lifting capabilities of the equipment being used.

Never lift batteries by terminal posts. Always lift batteries by the module mounting holes using the lifting straps that are provided. (See Figure 6-1.) Never lift more than one module at a time by the module mounting holes.

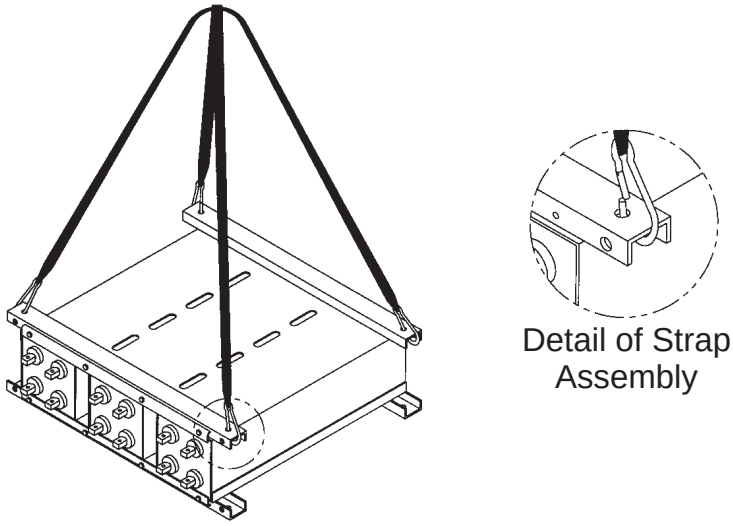


Figure 6-1: Unigy® II Battery Module with Lifting Straps

Specific Unpacking Instructions

Inspect the battery visually for shipping damage before it is completely unpacked. If it is determined that the battery should be returned to the manufacturer, it will be easier to return at this point than if the battery has been completely unpacked.

1. Examine the shipping container and record any signs of external damage.

2. Search for any indications of acid spillage during shipment. If acid spillage has occurred, record this information on the bill of lading before signing.

Note

Acid spillage is a valid criterion for rejection of product.

In case of acid spillage, refer to the Material Safety Data Sheet in Section 11 for instructions regarding cleanup and disposal. After unpacking, immediately check again for electrolyte spills.

Warning

Wear an eye protection device and acid resistant rubber gloves when cleaning up electrolyte spills. Wash hands and face thoroughly after use.

3. Check batteries for fractured jars and covers. Batteries with fractured jars and covers are defective and must not be used.

Note

Fractured cases and covers are valid criteria for rejection of product.

If a battery is found to be damaged when received, a claim can be initiated for replacement. The battery must be shipped back in its original carton.

4. Check the contents of the package against the packing list. Report any missing parts immediately.

5. The packing list includes the order number. Record this number on the “Installation and Maintenance Record.” The order number for new batteries must be recorded on this form for use in warranty validation.

6. While unpacking batteries for installation in the intended site, mark each cell with a number using an indelible-ink magic marker. Note its corresponding number and serial number in the appropriate column under "Voltage Measurements on Individual Batteries" on the Installation and Maintenance Record (see Section 10).

7. Identify all cells that will be used for monitoring cell temperatures. Temperature measurements should be made on one of the middle cells of a string. If a single shelf is provided for a string, monitor any one of the middle cells. If more than one shelf of cells is provided for a string, monitor the middle cell of each shelf. If more than one stand is provided, monitor the middle cell of each shelf on each stand. Decide on which cells will be used to represent battery temperature and note its number in the "Battery Number" column on the "Temperature Measurements on Selected Batteries" portion of the Installation and Maintenance Record. This will ensure that the same cell will be used for all future measurements.

Battery String Location

Environmental Requirements

The operating environment must comply with the National Electric Code Article 110, "Requirements for Electrical Installations," and Article 480-8, "Battery Locations," and any applicable state and local regulations.

The Unigy® II batteries, like all lead-acid batteries, are affected by the ambient temperature. Maintain a low ambient temperature and/or install a temperature compensation device that adjusts rectifier float voltages in response to high battery temperature.

Note

Lucent Technologies strongly recommends a temperature compensation device in high-temperature environments. Failure to use such a device may result in high battery temperature that can cause premature battery failure and may reduce or void the warranty.

Battery temperatures above 77°F (25°C) decrease battery life while increasing battery capacity. For battery temperatures lower than 77°F (25°C) the capacity will decrease, but battery life will not be adversely

affected. Battery temperatures within the same string must be maintained uniformly.

When batteries are installed where they will be exposed to heat radiation or direct sunlight, provide shields for the radiators or blinds for the windows to maintain a low battery temperature. In particular, the top row of a multi-tiered stand is apt to have a higher environmental temperature than the bottom. Where necessary, use fans or other means of ventilation to minimize the temperature variation.

Lucent Technologies recommends allowing a minimum 36" aisle space in front of the battery for maintenance and inspection. Provide a minimum 4" spacing from walls.

Caution

Operating Lucent Technologies Unigy® II batteries for any significant interval of time outside recommended voltages and/or temperatures will cause reduced performance and premature failure and may reduce or void the warranty.

Mixing Batteries in a String

Note

To insure maximum battery performance, do not mix Lucent Unigy® II batteries with other types of batteries.

As batteries age, their characteristics change. As a general practice it is not recommended to mix new batteries with older batteries in a string. A weak battery in a string can cause the entire string to fail prematurely.

Battery Installation

Module Assembly

Unigy® II batteries are typically packaged in reverse order for ease of installation. Floor support channels are on top, followed by the bottom-most module (see Figure 6-2).

1. Unbolt and remove the floor support channels from the top of the battery.

2. Secure the floor support channels to the floor according to the job specifications.

3. Using the two straps provided, remove the top module and bolt it onto the floor support channels. (See Figure 6-3.)

Caution

Never lift more than one battery module at a time with the lifting straps.

4. Using the associated drawings, verify that the modules are in the proper order for installation; if not, follow the information on the drawing to complete the module installation.

Caution

Each battery is shipped with its own schematic. Verify that the polarization on the batteries matches the drawings.

5. Remove the next module and bolt it onto the first module. Repeat this procedure until the batteries are installed to the specified configuration.

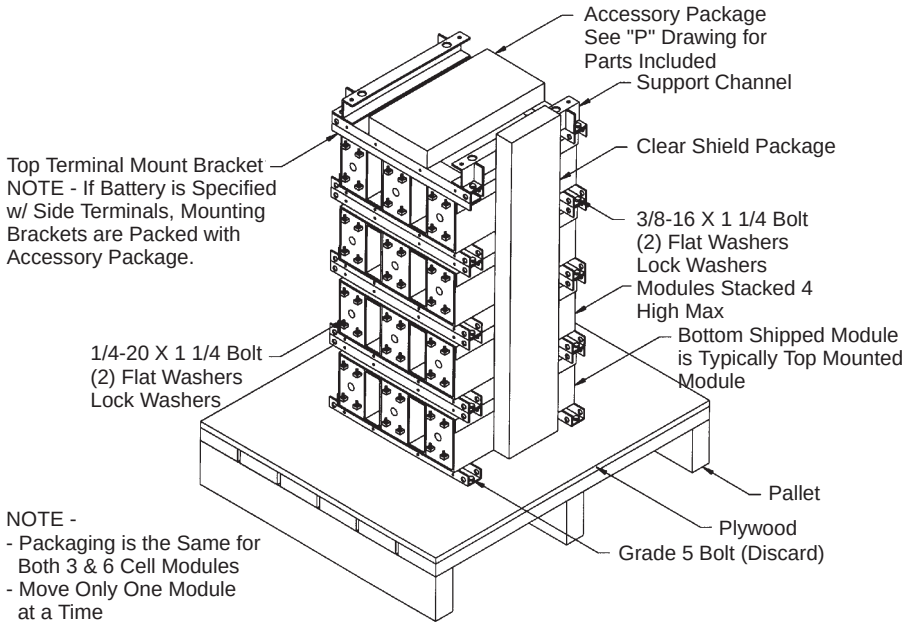


Figure 6-2: Unigy® II Battery Modules

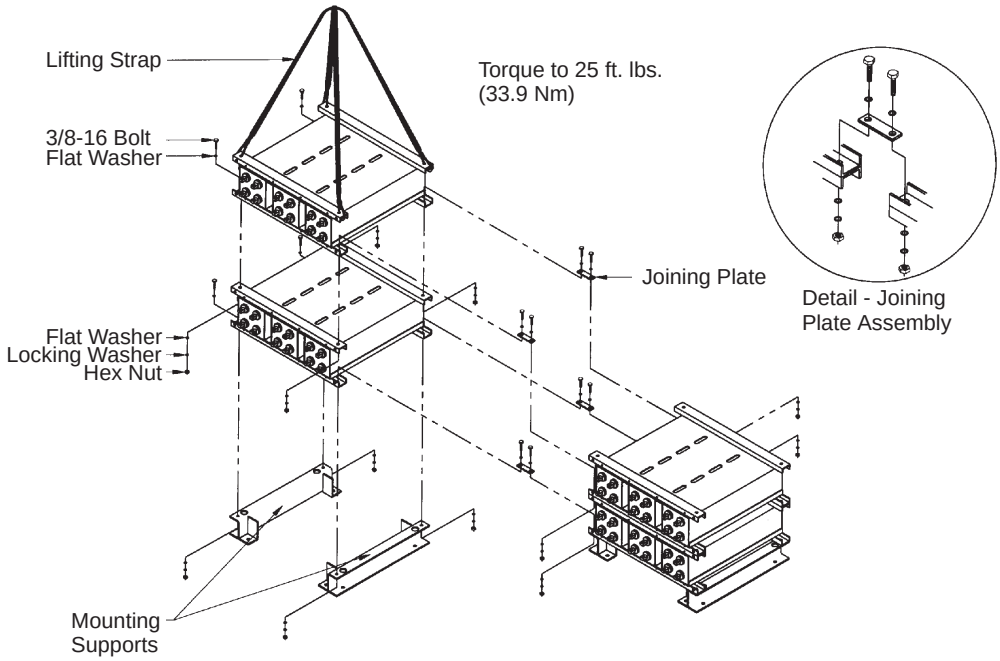


Figure 6-3: Battery Module Assembly

Relay Rack Assembly

Special order Unigy® II modules designed for installation in 23" relay racks may be assembled as follows (refer to Figures 6-4 through 6-6):

1. Attach the floor mounting brackets to the frame upright. (See Figure 6-4.)

2. Insert the module base support between the frame uprights; level and anchor. Anchor bolts are not included.

3. Using the associated drawings, verify that the modules are in the proper order for installation; if not, follow the information on the drawing to complete the module installation.

4. Using the lifting straps provided, remove the top module from the shipping pallet and bolt it to the module base support. (See Figure 6-5.)

Caution

Never lift more than one module at a time with the lifting straps.

5. Remove the next module and bolt it to the first module. Repeat this procedure until the battery is installed to the specified configuration.

6. Insert the stabilizing bracket and bolt it to the top module. (See Figure 6-6.)

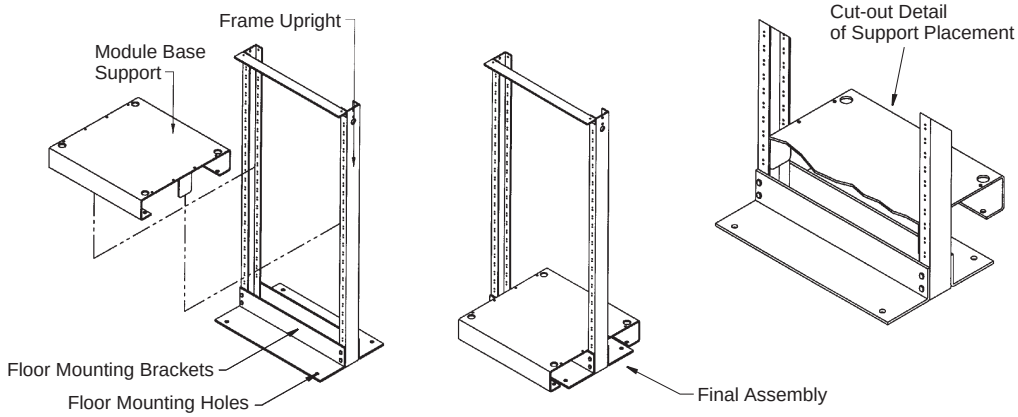


Figure 6-4: Base Support Placement

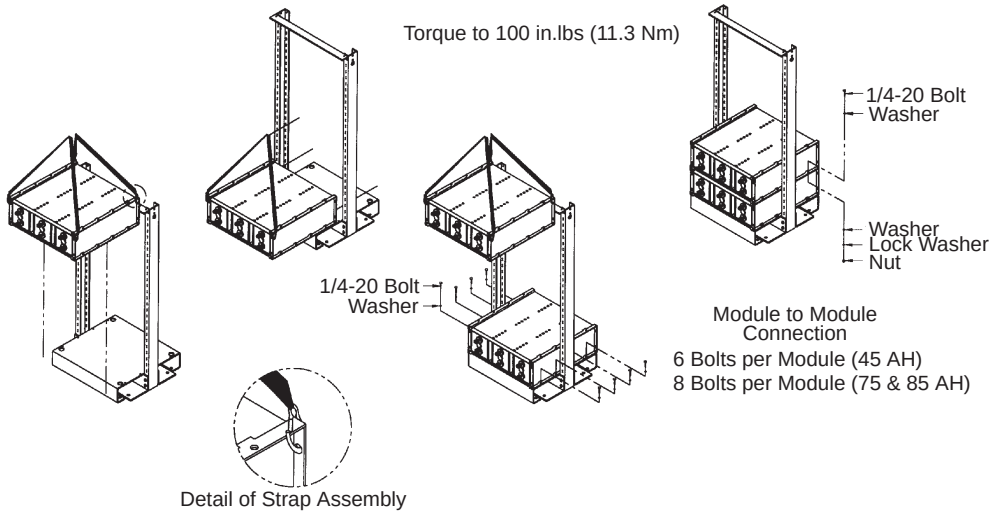


Figure 6-5: Module Placement

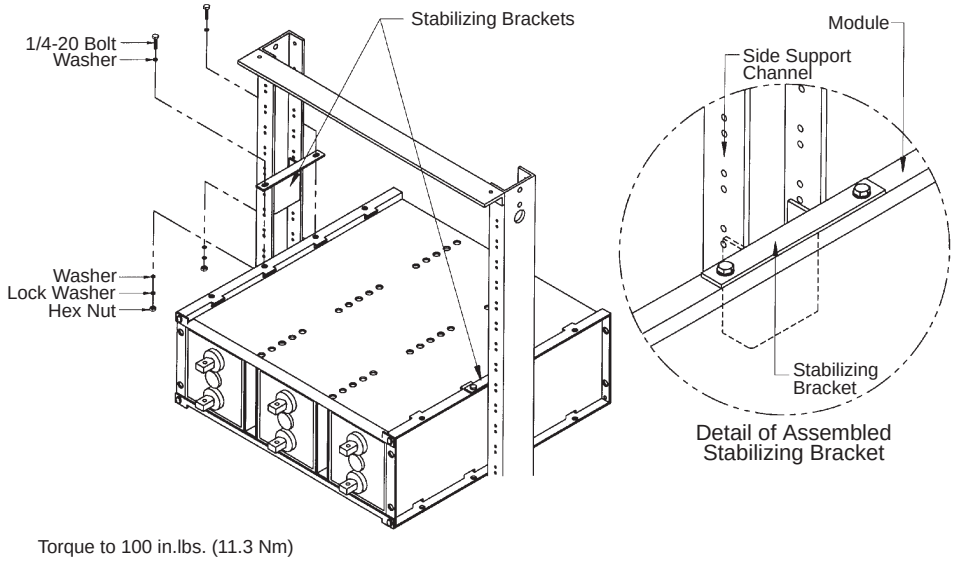


Figure 6-6: Stabilizing Bracket Placement

Electrical Connections

When all battery modules have been installed and secured, the modules may be electrically connected, verified, and identified.

Connector Assembly

Note: The contact surfaces of each individual post on every cell have been cleaned and coated with a thin film of NO-OX ID A® grease at the factory.

1. The intercell connector contact surfaces should be cleaned by rubbing gently with a non-metallic brush or pad. Apply a thin film of NO-OX ID A®, which has been supplied with the batteries.

2. Install all intercell connectors loosely to allow for final alignment of the batteries, then torque the connections to 100 ± 5 inch-pounds (11.3 ± 0.5 Nm).

   When more than one intercell connector is required, place the connectors on each side of the terminal (see Figure 6-7).

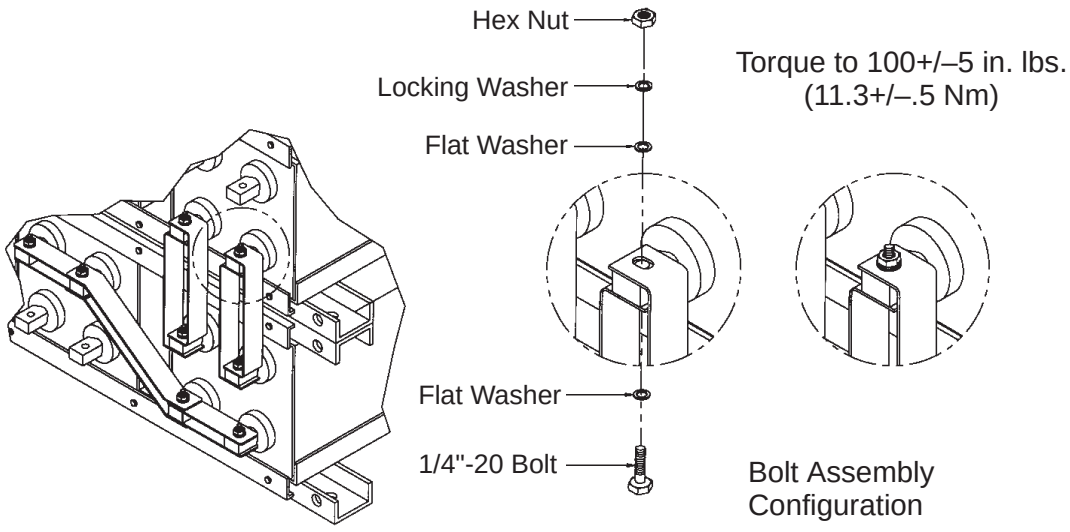


Figure 6-7: Connector Assembly

Terminal Assembly

1. Attach the terminal mounting bracket to the module frame. For side terminal assembly, follow Steps 1 through 4 in Figure 6-8; for top terminal assembly, see Figures 6-9 (Steps 1 through 3) and 6-10.

2. Attach the terminal plates to the battery posts and then to the mounting bracket.

3. For cable connection assembly, refer to Figure 6-11.

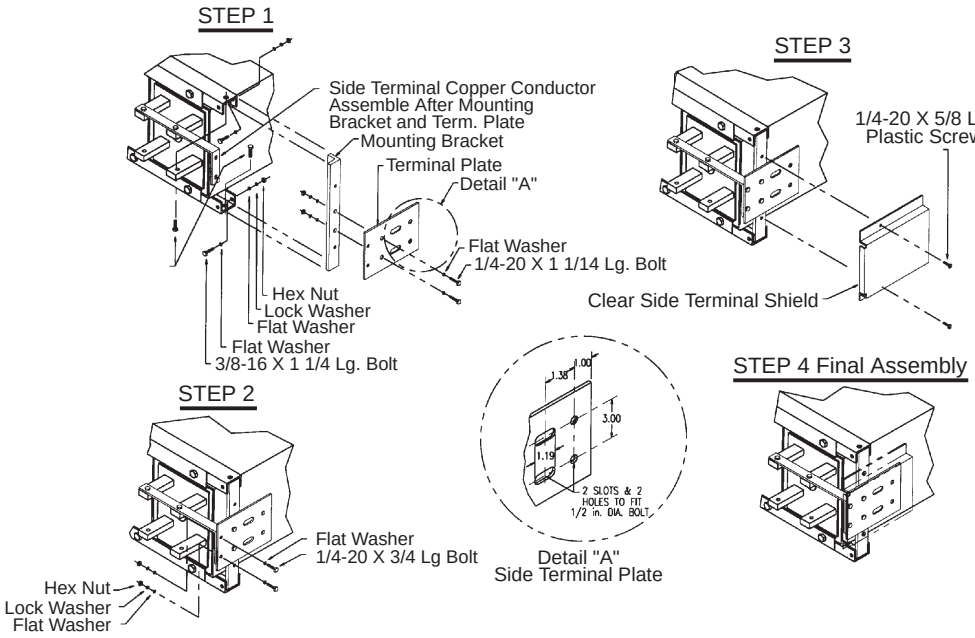


Figure 6-8: Side Terminal Assembly

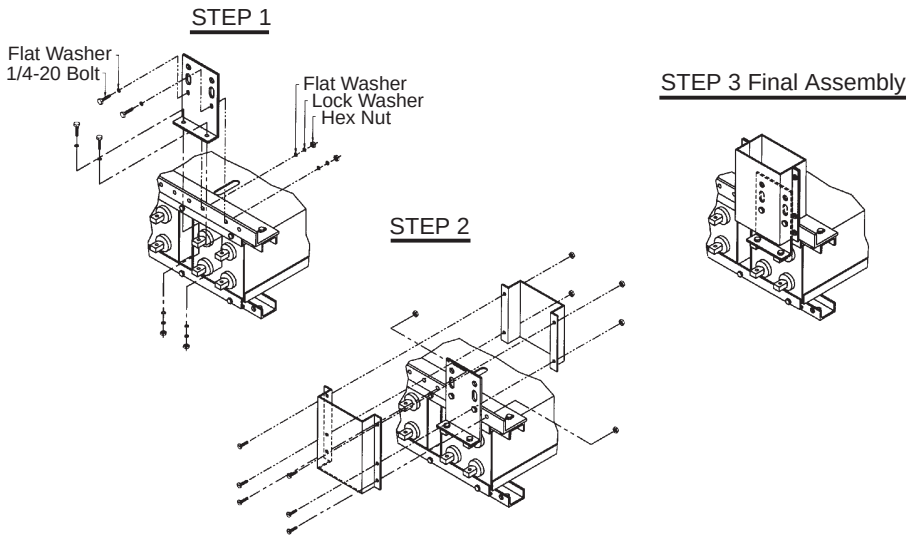


Figure 6-9: Top Terminal Assembly

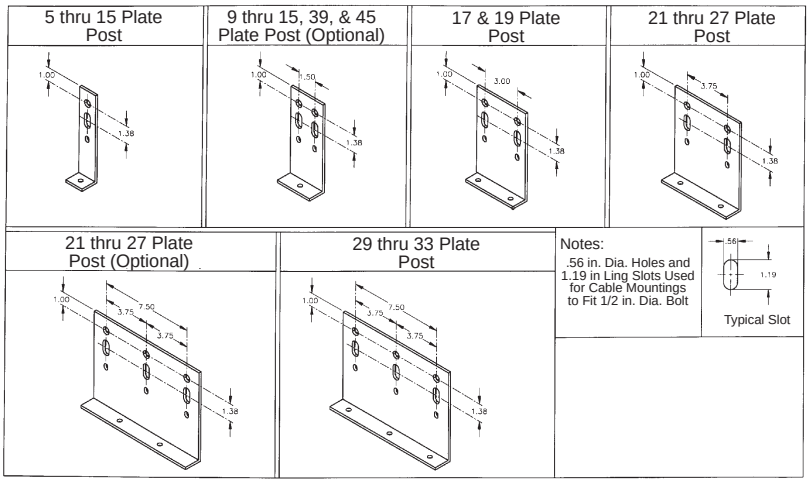


Figure 6-10: Top Terminal Assembly

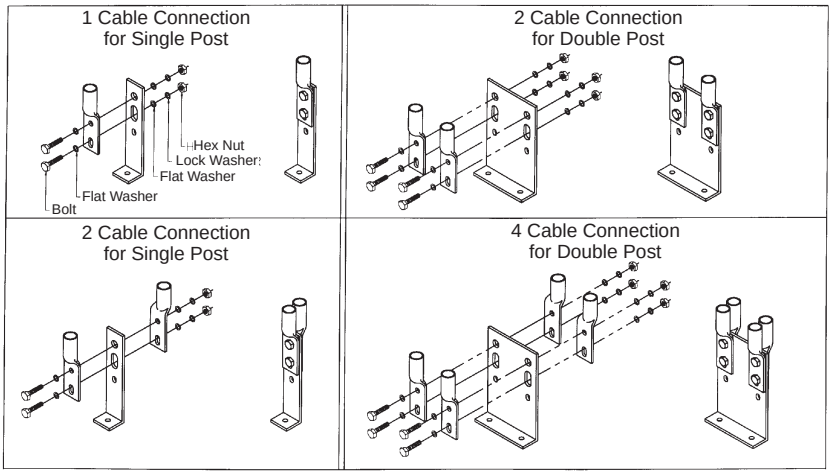


Figure 6-11: Cable Connection Assembly

Final Assembly and Verification

1. For future identification and record keeping, number individual cells in sequence (as identified in the schematic shipped with the battery), beginning with the number one at the positive end of the first battery.

2. After torquing the electrical connections on assembled modules, read the voltages of the battery to assure that the individual cells are connected correctly. The total voltage should be approximately equal to the number of cells times the measured voltage of one cell. If the measurement is less, recheck the connections for proper polarity.

Initial Charging

To ensure full charge and adequate initial performance, store and maintain batteries according to instructions in Section 5, *Battery Storage*, and use the guidelines in this section to charge the batteries at the time of installation.

The purpose of an initial charge is to compensate for self- discharge that occurred in the interval between manufacture and installation. Under normal circumstances, the battery will regain most of its capacity after several hours float charge; 90% capacity should be obtained within 24 hours of float charge.

Caution

Make sure the batteries are at equal float charge before connecting them into a string.

See Table 6-A for detailed initial charging instructions.

Table 6-A: Initial Charging

Battery Condition	Action
All batteries have similar date codes and storage histories and none are more than 6* months old or they have been maintained according to the "Battery Storage" section of this product manual.	Make voltage and polarity checks and connect string(s) to plant. Charge at the float voltage of 2.25 ± 1% volts per cell for the 3A and 6A series and charge at 2.25 ± 1% volts per module for the 1A series.
The batteries have dissimilar date codes (more than one month apart) and they are within the required recharge period (charge-by date).	Using an external charger**, charge the string at 2.30 ±0.03V per cell for the 3A and 6A series and charge at 2.30 ±0.03V per module for the 1A series until all cells have voltages within 0.1 volts of each other. Continue this charge up to 24 hours. Reduce to plant float voltage for 24 hours. **Do not charge for more than 24 hours at the higher voltage (2.30 VPC)**. Make voltage and polarity checks and connect string(s) to plant.
The batteries are older than 6* months or have not been maintained according to the "Battery Storage" section of this product manual.	Consult supplier for boost charging instructions.
*If the storage temperature exceeds 90°F (32°C), the open circuit time should not exceed 4 months. ** The charger must have overcurrent protection in its output, must be able to remain across the batteries in case of an ac power failure, and should not have crowbar protection. (Crowbar protection is an option used on some commercial portable power supplies that clamps a short across the output leads of the rectifier when the rectifier senses a higher voltage at the load than it is generating. This feature should not be used with batteries.)	

Placing a Battery String Into Service

Batteries should be in service within 48 hours of initial charge. If a battery is left on open circuit for more than 48 hours after the initial charge, treat it as if it had never received an initial charge.

Since battery performance is based on the output at the battery terminals, the shortest electrical connection between the battery system

and the operating equipment results in maximum total system performance.

Cable size should be specified and installed that will maintain appropriate voltage drop between the battery system and the operating equipment. Excess voltage drop will reduce the desired reserve time of the battery system.

When paralleling valve-regulated batteries, the capacity, arrangement, and external circuit length should be identical for each battery. Wide variations in the battery circuit resistance can result in unbalanced charging (i.e., excess charging current in some batteries and undercharging in others). As a result, cell failures in one battery string and subsequent loss of performance capabilities of that string will result in higher loads in the other parallel string(s), which may exceed the ratings of the battery connections. This can damage the battery and dramatically shorten battery life.

Installation Records

The "Installation and Maintenance Record" (see Section 10) is required for warranty validation. The installer should use this form to record the following measurements.

Voltage Measurements

Before connecting parallel strings together or individual strings to the plant bus, make three voltage measurements:

1. Make the first reading across the string to verify that the batteries are connected properly and that the polarity is correct. (The string voltage should approximately equal the average cell voltage times the number of cells.)

2. Make the second measurement across the plant charge and discharge battery buses. The voltage difference between the string and plant should not exceed 0.05 volts unless the plant is at 0 volts because the chargers are turned off. If a larger differential exists, the string should be charged at the plant voltage (or the plant voltage lowered) until the voltage differential is less than 0.05 volts. (This should prevent arcing during the final connection.)

3. Make the final reading to record voltages of individual cells. (See "Individual Cell Voltages" in Section 8, *Maintenance,* for measurement procedure.) Record these in the Installation and Maintenance Record.

A DMM (digital multimeter) is suitable for battery voltage readings. The accuracy of an equivalent meter should be 0.05 percent on the dc scale. The meter must be checked periodically for accuracy and calibration.

Caution

Exercise extreme caution when making voltage readings to prevent accidental grounding or shorting of leads during measuring operations. Connections at the meter must be secure and free of any possibility of touching or becoming grounded. Never remove connections at the meter end without first disconnecting the test leads from the battery. Remove test lead connections at the battery immediately after each reading is taken. Review the safety precautions in Section 4.

After recording these initial measurements, the installer should turn the Installation and Maintenance Record over to the maintenance organization as part of their permanent records. See Section 8, *Maintenance*, for maintenance routines and measurements that must be recorded.

Attaching Module Shield Assemblies

1. Remove the clear protective covering from the shields, attach the standoffs to the front shields, and fasten the nuts as shown in Figure 6-12.

Note

Use the long standoffs for the four corners and the short standoffs for the center holes.

2. Insert the fully assembled front shields through the holes in the front of the battery modules until the standoffs lock in place.

3. For side terminal assembly, attach the top shield to the highest front shield as shown in Figure 6-13. For top terminal assembly,

cut the top shield to fit between the terminal shields and attach it to the highest front shield as shown in Figure 6-14.

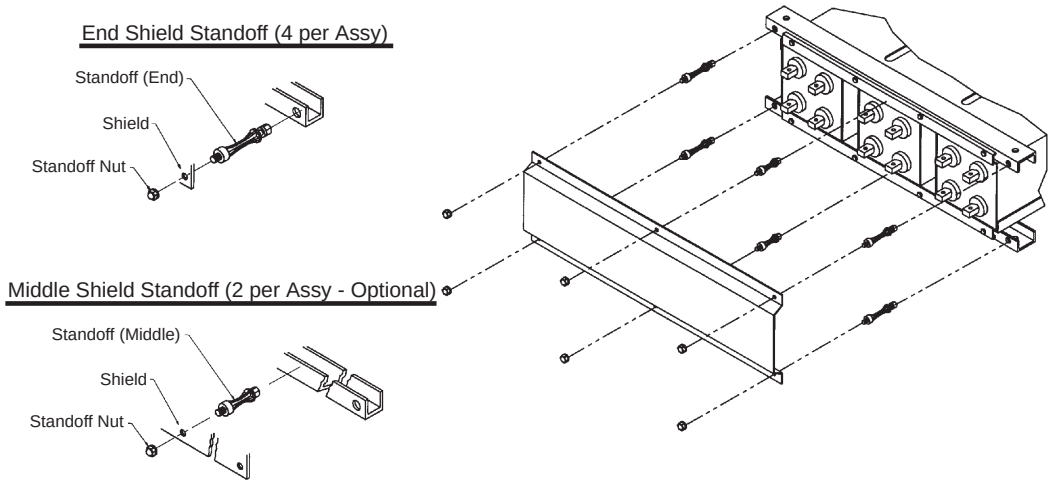


Figure 6-12: Module Shield Assembly

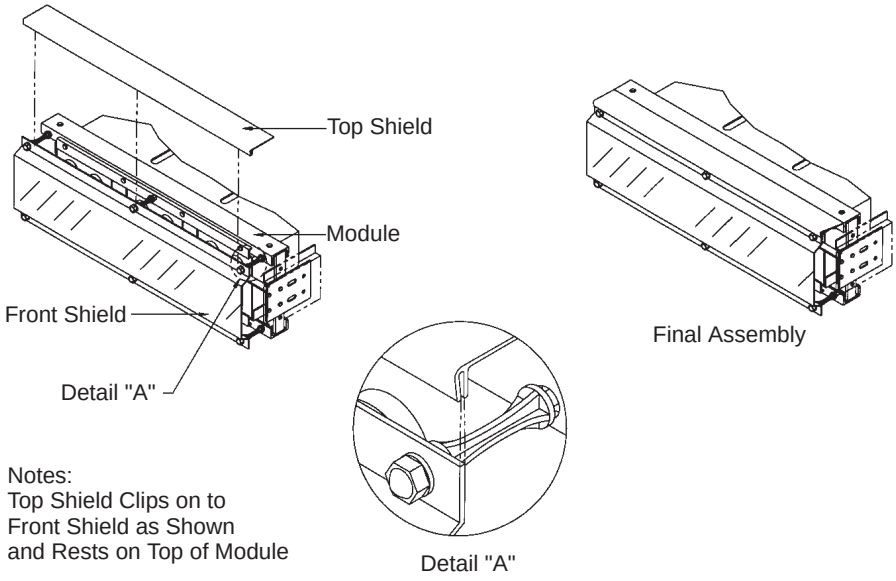


Figure 6-13: Side Terminal Assembly

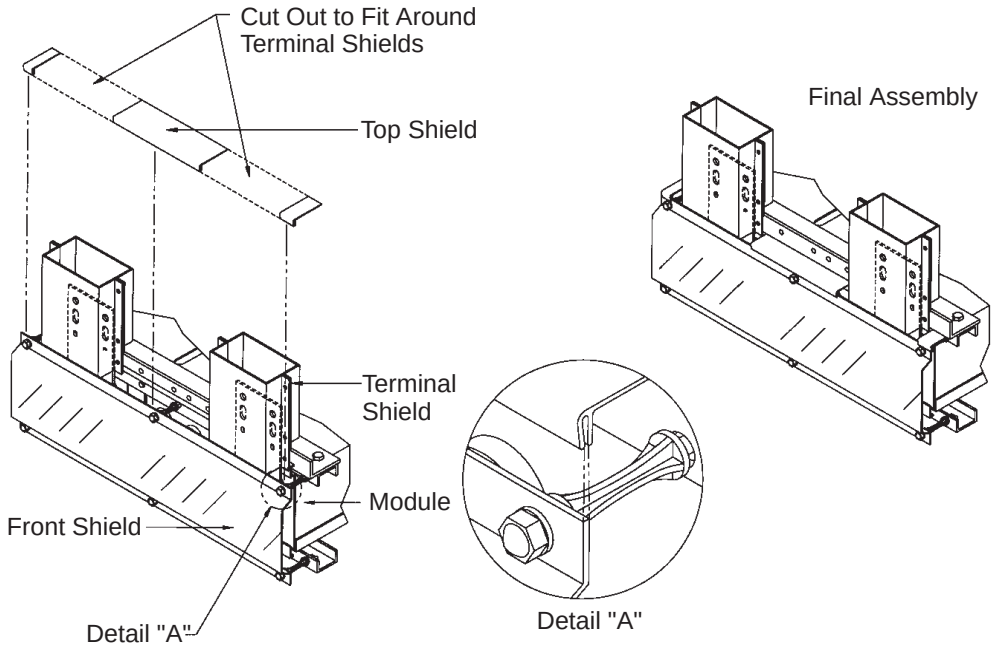


Figure 6-14: Top Terminal Assembly

7 Operation

Lead-acid Battery Gassing Rate

This section provides general information and guidelines for estimating the hydrogen gassing rates of lead-acid batteries on charge. It is beyond the scope of this document to provide the detailed methods or the engineering design required to maintain safe levels of hydrogen in battery enclosures.

All lead-acid batteries generate hydrogen and oxygen gas at the negative and positive plates, respectively. The generation of these gases occurs during all conditions of use, including charge, discharge, and while on open circuit during storage. The rate of gas generation on discharge and open circuit is generally very small but cannot be completely ignored. For this reason, never place lead-acid batteries in an air-tight enclosure. Explosive mixtures of hydrogen in air are present when the hydrogen concentration exceeds four (4) percent by volume. The concentration of oxygen does not significantly change the lower explosive limit of hydrogen in air, and, therefore, only hydrogen will be considered here.

If the concentration of hydrogen in air exceeds four (4) percent by volume, there is a risk of explosion if the gas is ignited. Therefore, to provide a margin of safety, lead-acid battery areas must be ventilated to limit the accumulation of hydrogen gas under all anticipated use conditions to a recommended maximum of one (1) percent of the total free volume in the enclosed battery area.

In flooded lead-acid batteries, gassing rates approach the theoretical values calculated from the dissociation of water. In valve-regulated lead-acid batteries (VRLA) the recombination of oxygen gas at the negative electrode results in reduced oxygen and hydrogen evolution from the battery. Generally, VRLA batteries evolve from less than 1% to 20% of the hydrogen produced by flooded lead-acid batteries under similar charging currents, and are designed to achieve greater than 95% recombination efficiency at normal float charge and temperature. However, charging at voltages greater than the nominal float voltage,

charging at elevated temperatures, shorted cell(s), and a number of other possible conditions may result in significantly greater charging current and hydrogen gassing. It is important to note that the hydrogen gassing rate at 0% recombination, the worst case condition, is the same for both flooded and valve-regulated technologies at equivalent charging currents and temperatures.

From electrochemical theory, if all the charging current is used to generate gas, each cell will generate 0.016 cubic feet of hydrogen per hour, per ampere of charging current at 77°F (25°C) and one atmosphere pressure. For example, a 48V string of lead-acid batteries requiring 1 ampere of float current at 77°F can produce as much as 0.4 cubic feet of hydrogen per hour (0.016ft3/hr x 1 ampere x 24 cells), or as little as 0.004 cubic feet per hour at 99% recombination efficiency, a factor of 100 difference.

The quantity of fresh air required to maintain an explosion-safe environment in the battery area (enclosure) will vary greatly depending on many factors including, but not limited to, the age and condition of the battery, the number of cells in the battery area, the battery temperature, and the current flowing through the batteries. Therefore, the design of a ventilation system for batteries in a specific application requires careful consideration of factors other than the gassing rate of new batteries in typical operation. Typical gassing rates may be useful as a “best case” condition, but cannot adequately address “worst case” or any other operating condition that may occur during the service life of the battery.

Service Life

Since battery temperature exceeding 77°F (25°C) will decrease expected life by approximately 50% for each 15°F (8.33°C) increase in average temperature, it is important to consider the temperature of the battery environment when designing equipment or determining battery life expectancy.

Charging

Lucent Technologies Unigy® II batteries are designed to operate with a float voltage of 2.25 volts per cell and are recommended for float-standby applications at 77°F (25° C). If the batteries must be operated in high temperature (greater than 77°F or 25°C) environments without temperature compensation, the battery float voltage should be adjusted as shown in Table 7-A.

Table 7-A: Float Voltages

Battery Temperature Degrees F/C	% of Capacity	% of Normal Life Expectancy	Per Cell Float Voltage
50/10	84	100	2.25
59/15	89	100	2.25
68/20	95	100	2.25
77/25	100	100	2.25
86/30	104	75	2.25
95/35	107	50	2.23

Caution

Operating Lucent Technologies Unigy® II batteries for any length of time outside the recommended voltages and/or temperatures will result in reduced performance and premature failure and may reduce or void the warranty.

In order to reduce the effects of sustained high temperature operation, the battery float voltage should be reduced at higher battery temperatures. For systems without a temperature compensation device, it is recommended that the float voltage be reduced by 3mV/°C/module for the 1A series, 9mV/°C/module for the 3A series, and 18mV/°C/module for the 6A series for temperatures above 30°C (86°F). This adjustment is automatically performed in systems with either a step or a slope compensation device.

Caution

Failure to reduce float voltages in systems without temperature compensation may result in premature failure or thermal run-away.

Battery String Float Voltage

It is extremely important to maintain the batteries at the proper float voltage. The recommended float voltage per cell is 2.25 volts ± 1% at a battery temperature of 77°F (25°C).

To determine the battery string float voltage, use the following equation:

Battery String Float Voltage = recommended float voltage per cell x number of cells for the 3A and 6A series. For the 1A: recommended float voltage per module x number of modules.

For example, a 24-cell string of Unigy® II batteries should be floated at:

Battery String Float Voltage = 2.25 volts x 24 cells = 54.00 volts

Charging Voltage Ripple

The amount of ac voltage ripple present on the charging voltage for the battery can seriously affect battery performance. Excessive ripple could result in sharply reduced battery life and increased gassing rates. Refer to "Lead-acid Battery Gassing Rate."

Both the amplitude and frequency of the ripple affect the degree of battery degradation. As a guideline, the charging voltage ripple for the Unigy® II battery should not exceed 10mV peak to peak per cell or last longer in duration than 8mSec.

Caution

AC charging ripple greater in magnitude than 10mV peak to peak per cell or longer in duration than 8mSec should not be used without prior consent of Lucent Technologies; failure to comply can void the warranty.

Battery and Ambient Temperatures

Ambient temperature can affect the capacity and life of the Unigy® II batteries. The temperature that has the most direct effect is the battery's internal temperature. All valve-regulated lead-acid batteries use oxygen recombination technology, which generates more heat than conventional flooded batteries. As a result, the battery temperature is often higher than the ambient temperature.

The Warranty Period outlined in Section 12 is based on the battery temperature, not the ambient temperature. Maintain a low battery temperature by adjusting the ambient environment temperature and/or air ventilation. Elevated battery temperatures (greater than 25°C or

77°F) decrease battery life while increasing battery capacity (see Section 6, "Environmental Requirements"). Low temperatures do not affect battery life; however, capacity decreases with decreasing temperatures. Applications should allow for battery temperatures within the same string to be uniform.

Caution

Operating Lucent Technologies Unigy® II batteries for any length of time outside the recommended voltages and/or temperatures will cause reduced performance and premature failure and reduce or void the warranty.

Since hot air rises, the top row of a multi-tiered stand configuration is likely to have higher temperatures than the bottom row. When necessary, use fans or other means of ventilation to minimize temperature variations between modules in the same string.

Caution

Lucent Technologies strongly recommends a temperature compensation device in high-temperature environments. Failure to use such a device may result in high battery temperature that can cause premature battery failure and reduce or void the warranty.

Capacity

The capacity of a battery or a string is expressed as a percent of its rated value. For example, if a battery is discharged at the 5-hour rate and it lasts 5.25 hours before reaching 1.75 volts/cell, it is said to have 105% of its rated capacity.

Temperature Correction for Capacity

The capacity of a battery varies slightly with temperature. See Figure 7-1 for temperature correction information.

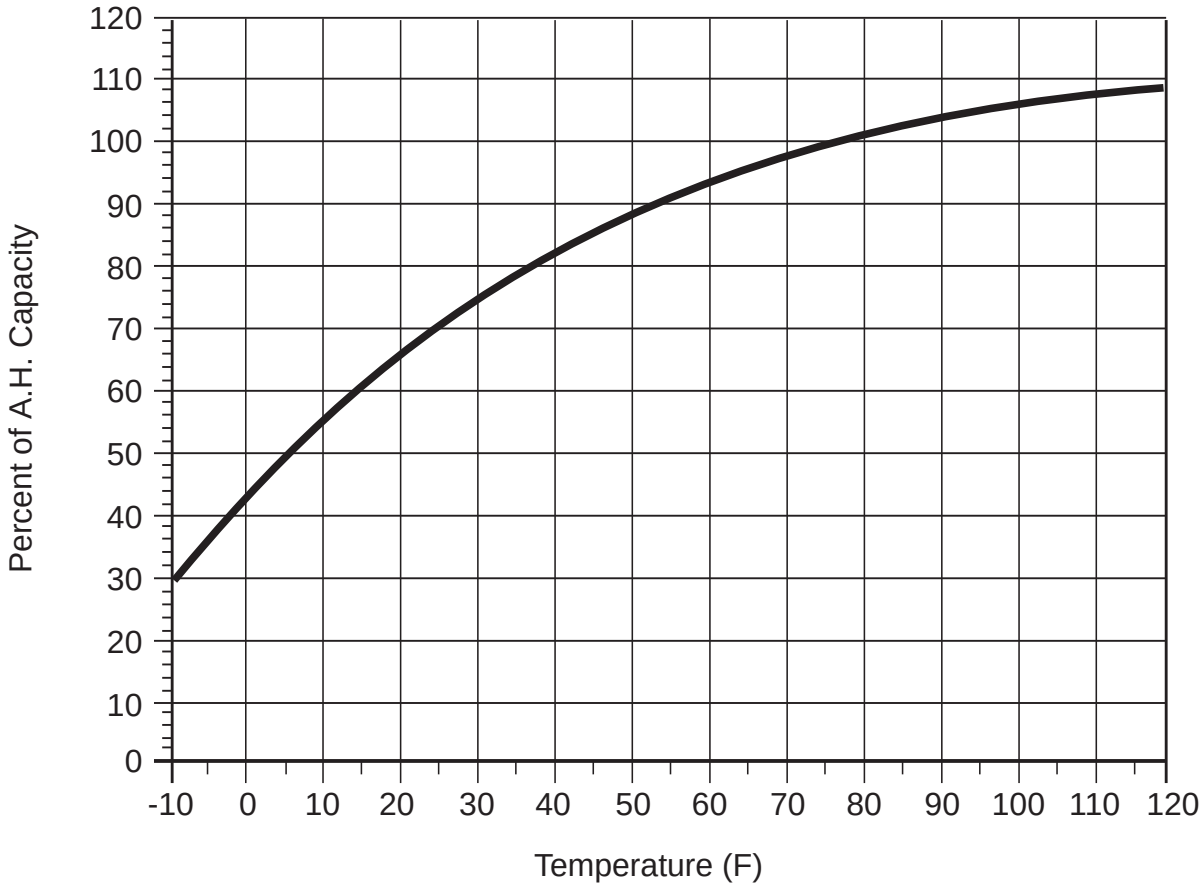


Figure 7-1: Temperature Correction Chart

Discharge Capacity Test

Capacity tests are not recommended for Unigy® II batteries unless the battery operation is questionable. Do not discharge the batteries beyond the specified final voltage. Record all findings.

The discharge capacity test should be run directly off float charge without prior boost charge. Battery strings to be tested should be on float for at least one month without a boost charge or power failure exceeding 30 minutes.

Recharge After Discharge

Recharge at the normal float voltage of 2.25 volts per cell for the 3A and 6A series and at 2.25 volts per module for the 1A series. The recharge should begin as soon as possible after the discharge.

Boost Charge

Boost charging the Unigy® II batteries is not recommended without the concurrence of Lucent Technologies. Call 1-800 225-7822 for technical assistance.

During a boost charge, water loss due to electrolysis is greatly increased. In valve regulated, lead acid cells, frequent or prolonged boost charges can result in premature failure caused by cell dry-out. Boost charging at elevated battery temperatures can be especially detrimental to the batteries.

8 Maintenance

Maintenance Schedule

Proper maintenance ensures good performance, provides an opportunity to view trends as they develop, and ensures that the product remains under warranty coverage.

Table 8-A lists the required routines and intervals for maintaining the Unigy® II batteries. "Paragraph Reference" refers to the procedures for performing the routines that follow the table. (The procedures and intervals are the same for all models of the Unigy® II battery.)

Table 8-A: Required Maintenance Routines

Routine	Action	Interval	Paragraph Reference
Individual Cell Voltages	Measure/Record	Quarterly	"Individual Cell Voltages"
Battery Temperature	Measure/Record	Quarterly	"Measuring Battery Temperatures"
String Current Measurement	Measure/Record	Quarterly	"String Current Measurement"
Inter-module Connections of Module and Rack	Inspect	Quarterly	"Inspection and Cleaning"
	Clean	As needed	"Inspection and Cleaning"
	Retorque	As needed	"Retorquing Inter-battery Connections"
Note: Failure to adhere to these maintenance schedules and to record results will void the warranty.			

Maintenance Routines

When performing any maintenance activities, it is essential to follow all safety procedures outlined in Section 4.

Warning

An explosion could occur when sparks are created near the battery string. Use insulated tools and discharge all static electricity from your body before performing any work.

Section 10, *Installation and Maintenance Record,* contains a form for recording the measurable parameters noted in Table 8-A. The maintenance person taking these measurements should include the date on which measurements were taken as well as their initials. This information will aid in establishing trends that can be used to determine overall health of the batteries. The completed forms will be used for any future warranty claims.

Individual Cell Voltages

Caution

Exercise extreme caution when making voltage readings to prevent accidental grounding or shorting of leads during measuring operations. Connections at the meter must be secure and free of any possibility of touching or becoming grounded. Never remove connections at the meter end without first disconnecting the test leads from the battery. Remove test lead connections at the battery immediately after each reading is taken. Review the safety precautions in Section 4.

Using a calibrated digital voltmeter with at least two-digit accuracy, measure the voltage across each battery terminal to ensure they are floating properly. Record the data in the space provided on the "Voltage Measurements on Individual Batteries" portion of the Installation and Maintenance Record.

When making voltage measurements, please note the following:

- Readings for each cell must be within ±0.05 volts of float voltage.
- Any cell that reads less than 2.15 volts is considered to be shorted and must be replaced.
- Battery float voltage readings are affected by discharges and recharges. These readings must be taken when the batteries have

been on continuous, uninterrupted float operation for at least one month.

Measuring Battery Temperatures

Make temperature measurements using calibrated equipment, such as an infrared-based or thermocouple-based measuring device. Make all measurements on the negative terminal of the selected batteries. If using a thermocouple device, place the sensor on the negative terminal of the battery and wait a few seconds for the meter to stabilize. Note the measured value in the appropriate column on the "Temperature Measurement on Selected Batteries" portion of the Installation and Maintenance Record.

String Current Measurement

Use a calibrated DMM and current probe placed around a string cable to make individual battery string current measurements. Note the measured value in the appropriate column in the "String Float Current Measurements" portion of the Installation and Maintenance Record.

Inspection and Cleaning

A visual inspection of the battery plant should be done on a quarterly basis. If necessary, the battery modules and racks can be cleaned using a soft cloth dampened in water. The inter-battery connections should be inspected for corrosion. Report any sign of acid or corrosion to Lucent Technologies.

Retorquing Inter-battery Connections

Ensure that all battery connections are tight. If required, retorque the connections to 100 ± 5 inch-pounds (11.3 ± 0.5 Nm). Use insulated torque and 6-point socket wrenches to tighten connections.

Caution

Over-tightening of the inter-module connectors could strip the bolt and/or nut threads, resulting in loose connections.

Flame Arrestor Vent Feature

The vent and flame arrestor are maintenance free and do not require attention under normal circumstances. **However, do NOT allow gas vents to become clogged or excessive internal pressure may result.**

Cell Replacement

New Unigy® II modules or cells may be intermixed directly into an existing string of older Lucent Technologies Unigy® II batteries (of the same nominal capacity) only when necessary for replacement purposes.

Should it become necessary to replace one or more modules or cells in a string, the replacement batteries must be charged according to Table 6-A. Following the initial charge, keep the module/cell on continuous float at 2.25 volts per cell (3A or 6A series) or per module (1A series) until the replacement can be made. The time between discontinuing the float charge and the completion of the replacement should not exceed 24 hours.

Before removing any cells, refer to the safety precautions in Section 4 of this manual.

Warning

Do NOT attempt to remove cells unless the battery has been off of charge or on continuous float for at least 24 consecutive hours. Do NOT attempt removal if there has been a power outage within the last 24 hours.

Figures 8-1 through 8-3 describe the procedures for cell replacement.

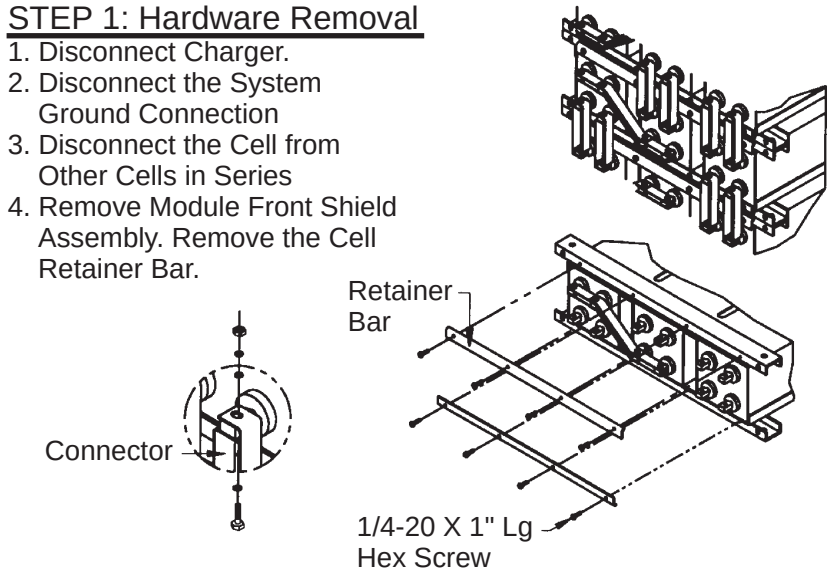


Figure 8-1: Hardware Removal

STEP 2: Valve Removal

1. Pry Vent Shroud Off.
2. Remove Flame Arrestor
3. Unscrew Valve with 17mm Hex Key. (Pressure Will Release) Remove Valve.
4. Replace with Valve Immediately. Torque Valve to 12-14 In. Pounds with 17mm Hex Key.
5. Replace with New Flame Arrestor and New Shroud

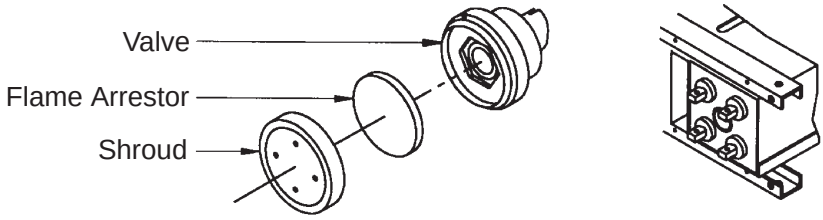
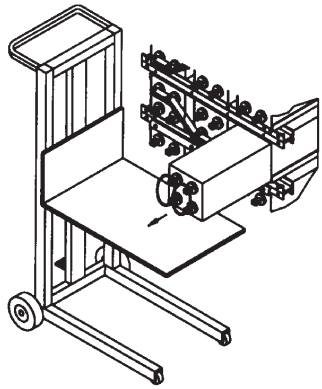
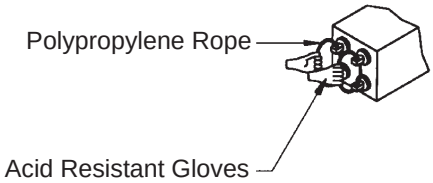


Figure 8-2: Valve Removal

STEP 3: Cell Removal

1. Thread Polypropylene Rope Through Two Terminals as Shown and Knot.
2. Pull Cell from Module Across Lift Truck as Shown.





STEP 4: Cell Replacement

1. Push Cell Back into Module. Check Polarity Orientation.
2. Remove Rope if Used.
3. Replace Retainer Bars.
4. Replace Connectors.
5. Reconnect Charger.

Figure 8-3: Cell Removal and Replacement

9 *Discharge and Power Data*

The following tables display power data for the Lucent Technologies Unigy® II battery.

Discharge Current Capacity Per Cell (Amps) **Cell Type: ICS-75**							**Final Volts - 1.75**			
No. Plates	1 Hr	2 Hr	3 Hr	4 Hr	5 Hr	6 Hr	8 Hr	10 Hr	12 Hr	24 Hr
5	87	54	41	33	28	25	20	16	14	8
7	130	80	61	50	42	37	29	25	21	12
9	174	107	82	66	56	49	39	33	28	16
11	217	134	102	83	70	61	49	41	35	20
13	261	161	123	100	84	73	59	49	42	23
15	304	187	143	116	98	86	69	57	50	27
17	347	214	163	133	112	98	79	66	57	31
19	390	241	184	150	127	110	88	74	64	35
21	434	268	204	166	141	122	98	82	71	39
23	478	295	225	183	155	135	108	90	78	43
25	521	321	245	200	169	147	118	98	85	47
27	564	348	265	216	183	159	128	107	92	51
29	608	375	286	233	197	171	138	115	99	55
31	651	402	306	250	211	184	147	123	106	59
33	694	428	327	266	225	196	157	131	113	63

Discharge Current Capacity Per Cell (Amps) **Cell Type: ICS-75**							**Final Volts - 1.78**			
No. Plates	1 Hr	2 Hr	3 Hr	4 Hr	5 Hr	6 Hr	8 Hr	10 Hr	12 Hr	24 Hr
5	80	51	38	31	27	23	19	16	14	8
7	120	76	58	47	40	35	28	24	20	11
9	160	101	77	63	53	47	38	31	27	15
11	200	126	96	79	67	59	47	39	34	19
13	240	151	115	94	80	70	57	47	41	22
15	280	176	135	110	94	82	66	55	48	26
17	320	201	154	126	107	94	75	63	54	30
19	360	227	173	141	120	105	85	71	61	34
21	400	252	192	157	134	117	94	79	68	37
23	440	277	212	173	147	129	104	86	75	41
25	480	302	231	188	160	140	113	94	82	45
27	520	327	250	204	174	152	123	102	88	49
29	560	352	269	220	187	164	132	110	95	52
31	600	377	289	235	201	175	141	118	102	56
33	640	402	308	251	214	187	151	126	109	60

Discharge Current Capacity Per Cell (Amps) **Cell Type: ICS-75**							**Final Volts - 1.81**			
No. Plates	1 Hr	2 Hr	3 Hr	4 Hr	5 Hr	6 Hr	8 Hr	10 Hr	12 Hr	24 Hr
5	76	49	38	31	26	23	19	16	13	7
7	114	74	57	46	39	35	28	23	20	11
9	153	98	75	62	53	46	37	31	27	15
11	191	123	94	77	66	58	47	39	34	19
13	229	147	113	93	79	69	56	47	40	22
15	267	172	132	108	92	81	65	54	47	26
17	305	196	151	124	105	92	74	62	54	30
19	343	221	170	139	118	104	84	70	60	33
21	381	245	189	154	131	115	93	78	67	37
23	420	270	207	170	145	127	102	86	74	41
25	458	294	226	185	158	138	112	93	80	45
27	496	319	245	201	171	150	121	101	87	48
29	534	343	264	216	184	161	130	109	94	52
31	572	368	283	232	197	173	140	117	101	56
33	610	392	302	247	210	184	149	124	107	59

Discharge Current Capacity Per Cell (Amps) **Cell Type: ICS-75**							**Final Volts - 1.84**			
No. Plates	1 Hr	2 Hr	3 Hr	4 Hr	5 Hr	6 Hr	8 Hr	10 Hr	12 Hr	24 Hr
5	71	48	37	30	26	23	18	15	13	7
7	106	71	55	45	39	34	27	23	20	11
9	142	95	73	60	51	45	36	30	26	15
11	177	119	91	75	64	56	45	38	33	18
13	213	143	110	90	77	68	54	46	39	22
15	248	166	128	105	90	79	63	53	46	26
17	283	190	146	120	103	90	72	61	53	29
19	319	214	165	135	116	101	82	68	59	33
21	354	237	183	150	129	112	91	76	66	36
23	390	261	201	165	141	124	100	84	72	40
25	425	285	219	180	154	135	109	91	79	44
27	461	309	238	195	167	146	118	99	85	47
29	496	332	256	210	180	157	127	106	92	51
31	531	356	274	225	193	169	136	114	99	55
33	567	380	293	240	206	180	145	122	105	58

Discharge Current Capacity Per Cell (Amps) **Cell Type: ICS-75**							**Final Volts - 1.88**			
No. Plates	1 Hr	2 Hr	3 Hr	4 Hr	5 Hr	6 Hr	8 Hr	10 Hr	12 Hr	24 Hr
5	66	44	34	29	24	22	17	15	13	7
7	99	66	51	43	37	32	26	22	19	11
9	132	88	69	57	49	43	35	29	25	14
11	165	110	86	71	61	54	43	36	32	18
13	198	132	103	85	73	65	52	44	38	21
15	231	154	120	100	86	75	61	51	44	25
17	264	176	137	114	98	86	69	58	50	28
19	297	198	154	128	110	97	78	65	57	32
21	330	220	171	142	122	107	87	73	63	35
23	363	241	189	156	135	118	95	80	69	39
25	396	263	206	171	147	129	104	87	76	42
27	429	285	223	185	159	140	113	95	82	46
29	462	307	240	199	171	150	121	102	88	49
31	495	329	257	213	183	161	130	109	95	53
33	528	351	274	228	196	172	139	116	101	56

Discharge Current Capacity Per Cell (Amps) **Cell Type: ICS-75**							**Final Volts - 1.90**			
No. Plates	1 Hr	2 Hr	3 Hr	4 Hr	5 Hr	6 Hr	8 Hr	10 Hr	12 Hr	24 Hr
5	59	41	32	27	23	21	17	14	12	7
7	88	62	48	41	35	31	25	21	18	10
9	118	82	65	54	47	41	33	28	24	14
11	147	102	81	68	58	52	42	35	31	17
13	177	123	97	81	70	62	50	42	37	20
15	206	143	113	95	82	72	58	49	43	24
17	235	164	129	108	93	83	67	56	49	27
19	265	184	145	122	105	93	75	63	55	31
21	294	205	161	135	117	103	83	70	61	34
23	324	225	178	149	128	113	92	77	67	38
25	353	245	194	162	140	124	100	84	73	41
27	383	266	210	176	152	134	108	91	79	44
29	412	286	226	189	163	144	117	98	86	48
31	441	307	242	203	175	155	125	105	92	51
33	471	327	258	216	186	165	133	112	98	55

Discharge Current Capacity Per Cell (Amps) **Cell Type: ICS-75**							**Final Volts - 1.94**			
No. Plates	1 Hr	2 Hr	3 Hr	4 Hr	5 Hr	6 Hr	8 Hr	10 Hr	12 Hr	24 Hr
5	52	36	29	24	21	19	15	13	11	6
7	78	54	43	36	31	28	23	19	17	9
9	104	72	57	48	42	37	30	26	22	12
11	130	90	71	60	52	47	38	32	28	16
13	156	108	86	72	63	56	45	38	33	19
15	182	126	100	84	73	65	53	45	39	22
17	208	144	114	96	84	74	60	51	44	25
19	234	162	129	108	94	84	68	58	50	28
21	260	180	143	120	105	93	75	64	56	31
23	286	198	157	132	115	102	83	70	61	34
25	312	216	171	144	125	112	90	77	67	37
27	338	234	186	156	136	121	98	83	72	40
29	364	252	200	168	146	130	106	89	78	43
31	390	270	214	180	157	139	113	96	83	47
33	416	288	229	192	167	149	121	102	89	50

Discharge Current Capacity Per Cell (Amps) **Cell Type: ICS-85**							**Final Volts - 1.75**			
No. Plates	1 Hr	2 Hr	3 Hr	4 Hr	5 Hr	6 Hr	8 Hr	10 Hr	12 Hr	24 Hr
9	185	119	91	74	63	55	44	37	32	17
11	231	149	114	93	78	68	55	46	40	22
13	278	179	137	111	94	82	66	55	47	26
15	324	209	159	130	110	95	77	64	55	31
17	370	239	182	148	125	109	87	73	63	35
19	417	268	205	167	141	123	98	82	71	39
21	463	298	228	185	157	136	109	91	79	44
23	509	328	250	204	172	150	120	100	87	48
25	555	358	273	222	188	164	131	110	95	52
27	602	387	296	241	204	177	142	119	103	57
29	648	417	319	259	219	191	153	128	111	61
31	694	447	341	278	235	204	164	137	118	65
33	740	477	364	296	250	218	175	146	126	70
39	833	536	410	333	282	245	197	164	142	78
45	972	626	478	389	329	286	230	192	166	92
51	1111	715	546	444	376	327	262	219	189	105
57	1250	804	615	500	423	368	295	247	213	118
63	1388	894	683	555	470	409	328	274	237	131
69	1527	983	751	611	517	449	361	301	260	144
75	1666	1073	819	666	564	490	393	329	284	157
81	1805	1162	888	722	611	531	426	356	308	170
87	1944	1251	956	777	658	572	459	383	332	183
93	2083	1341	1024	833	705	613	492	411	355	196
99	2221	1430	1092	888	751	654	525	438	379	209
* Experimental values for No. of Plates 5 - 33, extrapolated values for No. of Plates 39 - 99.										

Discharge Current Capacity Per Cell (Amps) **Cell Type: ICS-85**							**Final Volts - 1.78**			
No. Plates	1 Hr	2 Hr	3 Hr	4 Hr	5 Hr	6 Hr	8 Hr	10 Hr	12 Hr	24 Hr
7	132	86	66	54	46	40	33	27	23	13
9	177	115	89	73	61	54	43	36	31	17
11	221	144	111	91	77	67	54	45	39	22
13	265	173	133	109	92	81	65	54	47	26
15	309	201	155	127	108	94	76	63	55	30
17	353	230	177	145	123	108	87	72	63	34
19	397	259	199	163	138	121	98	81	70	39
21	441	287	221	181	154	134	108	90	78	43
23	486	316	244	199	169	148	119	99	86	47
25	530	345	266	217	184	161	130	108	94	52
27	574	374	288	236	200	175	141	117	102	56
29	618	402	310	254	215	188	152	126	109	60
31	662	431	332	272	231	202	163	135	117	64
33	706	460	354	290	246	215	173	144	125	69
39	795	517	399	326	277	242	195	162	141	77
45	927	603	465	380	323	282	228	189	164	90
51	1059	689	531	435	369	322	260	216	187	103
57	1192	776	598	489	415	363	293	243	211	116
63	1324	862	664	543	461	403	325	270	234	129
69	1457	948	731	598	507	443	358	298	258	142
75	1589	1034	797	652	553	484	390	325	281	155
81	1721	1120	684	706	600	524	423	352	305	168
87	1854	1206	930	761	646	564	455	379	328	181
93	1986	1292	996	815	692	604	488	406	351	193
99	2119	1379	1063	869	738	645	520	433	375	206
* Experimental values for No. of Plates 5 - 33, extrapolated values for No. of Plates 39 - 99.										

Discharge Current Capacity Per Cell (Amps) **Cell Type: ICS-85**							**Final Volts - 1.81**			
No. Plates	1 Hr	2 Hr	3 Hr	4 Hr	5 Hr	6 Hr	8 Hr	10 Hr	12 Hr	24 Hr
7	126	85	65	53	45	40	32	27	23	13
9	168	113	87	71	60	53	43	36	31	17
11	210	141	109	89	76	66	53	45	39	21
13	252	170	131	107	91	80	64	54	47	26
15	294	198	152	124	106	93	75	63	54	30
17	336	226	174	142	121	106	85	71	62	34
19	378	254	196	160	136	119	96	80	70	38
21	420	282	218	178	151	132	107	89	78	43
23	462	311	239	195	166	146	118	98	85	47
25	504	339	261	213	181	159	128	107	93	51
27	546	367	283	231	196	172	139	116	101	55
29	588	395	305	249	212	185	150	125	109	60
31	630	423	326	266	227	199	160	134	116	64
33	672	452	348	284	242	212	171	143	124	68
39	756	508	392	320	272	238	192	161	140	77
45	882	593	457	373	317	278	224	188	163	90
51	1008	677	522	426	363	318	256	214	186	102
57	1134	762	588	479	408	353	288	241	209	115
63	1260	847	653	533	453	397	320	268	233	128
69	1386	931	718	586	499	437	352	295	256	141
75	1512	1016	783	639	544	477	384	321	279	153
81	1638	1101	849	692	589	516	417	348	302	166
87	1764	1185	914	746	635	556	449	375	326	179
93	1890	1270	979	799	680	596	481	402	349	192
99	2016	1355	1044	852	725	636	513	429	372	205
* Experimental values for No. of Plates 5 - 33, extrapolated values for No. of Plates 39 - 99.										

Discharge Current Capacity Per Cell (Amps) **Cell Type: ICS-85**							**Final Volts - 1.84**			
No. Plates	1 Hr	2 Hr	3 Hr	4 Hr	5 Hr	6 Hr	8 Hr	10 Hr	12 Hr	24 Hr
7	120	81	63	52	44	39	31	26	23	13
9	160	109	84	69	59	52	42	35	30	17
11	200	136	105	86	74	65	52	44	38	21
13	240	163	126	104	88	78	62	52	45	25
15	280	190	147	121	103	90	73	61	53	29
17	320	217	168	138	118	103	83	70	60	34
19	360	244	189	155	133	116	94	79	68	38
21	400	271	210	173	147	129	104	87	76	42
23	440	298	231	190	162	142	114	96	83	46
25	480	325	252	207	177	155	125	105	91	50
27	520	352	273	224	192	168	135	114	98	55
29	560	379	294	242	206	181	146	122	106	59
31	600	406	315	259	221	194	156	131	113	63
33	640	433	336	276	236	207	166	140	121	67
39	720	488	378	311	265	232	187	157	136	76
45	840	569	441	362	310	271	218	183	159	88
51	960	650	504	414	354	310	249	210	181	101
57	1080	731	567	466	398	349	281	236	204	113
63	1200	812	630	518	442	387	312	262	226	126
69	1320	894	693	569	486	426	343	288	249	138
75	1440	975	756	621	531	465	374	314	272	151
81	1560	1056	819	673	575	503	405	340	294	164
87	1680	1137	882	725	619	542	437	367	317	176
93	1800	1218	945	776	663	581	468	393	340	189
99	1920	1300	1008	828	708	620	499	419	362	201
* Experimental values for No. of Plates 5 - 33, extrapolated values for No. of Plates 39 - 99.										

Discharge Current Capacity Per Cell (Amps) **Cell Type: ICS-85**							**Final Volts - 1.88**			
No. Plates	1 Hr	2 Hr	3 Hr	4 Hr	5 Hr	6 Hr	8 Hr	10 Hr	12 Hr	24 Hr
7	107	75	59	49	42	37	30	25	22	12
9	143	100	79	66	56	49	40	33	29	16
11	179	125	98	82	70	62	50	42	36	20
13	214	150	118	98	84	74	60	50	43	24
15	250	175	138	115	98	86	70	59	51	28
17	286	200	157	131	112	99	79	67	58	32
19	321	225	177	147	126	111	89	75	65	36
21	357	250	197	164	140	123	99	84	72	40
23	393	275	216	180	154	136	109	92	80	44
25	429	300	236	196	168	148	119	100	87	48
27	464	325	256	213	182	160	129	109	94	52
29	500	350	275	229	196	173	139	117	101	56
31	536	375	295	245	210	185	149	125	108	60
33	571	400	315	262	224	197	159	134	116	64
39	643	450	354	295	253	222	179	150	130	72
45	750	525	413	344	295	259	209	176	152	84
51	857	600	472	393	337	296	238	201	173	96
57	964	675	531	442	379	333	268	226	195	109
63	1071	750	590	491	421	370	298	251	217	121
69	1178	825	649	540	463	407	328	276	238	133
75	1286	900	708	589	505	444	357	301	260	145
81	1393	975	767	638	547	481	387	326	282	157
87	1500	1050	826	687	589	518	417	351	304	169
93	1607	1125	885	736	631	555	447	376	325	181
99	1714	1200	944	785	673	592	477	401	347	193
* Experimental values for No. of Plates 5 - 33, extrapolated values for No. of Plates 39 - 99.										

Discharge Current Capacity Per Cell (Amps) **Cell Type: ICS-85**									**Final Volts - 1.90**	
No. Plates	1 Hr	2 Hr	3 Hr	4 Hr	5 Hr	6 Hr	8 Hr	10 Hr	12 Hr	24 Hr
7	97	69	55	46	40	36	29	24	21	12
9	129	93	74	62	53	47	38	32	28	16
11	161	116	92	77	67	59	48	40	35	20
13	194	139	110	93	80	71	57	48	42	23
15	226	162	129	108	94	83	67	57	49	27
17	258	185	147	124	107	95	76	65	56	31
19	291	208	165	139	120	107	86	73	63	35
21	323	231	184	154	134	118	96	81	70	39
23	355	254	202	170	147	130	105	89	77	43
25	387	277	221	185	160	142	115	97	84	47
27	420	300	239	201	174	154	124	105	91	51
29	452	323	257	216	187	166	134	113	98	55
31	484	346	276	232	201	178	143	121	105	59
33	516	369	294	247	214	189	153	129	112	62
39	581	416	331	278	241	213	172	145	126	70
45	678	485	386	324	281	249	201	170	147	82
51	775	554	441	370	321	284	229	194	168	94
57	872	623	496	417	361	320	258	218	189	105
63	968	692	551	463	401	355	287	242	210	117
69	1065	762	607	509	441	391	315	266	231	129
75	1162	831	662	556	481	426	344	291	252	140
81	1259	900	717	602	522	462	373	315	273	152
87	1356	969	772	648	562	497	401	339	295	164
93	1453	1038	827	694	602	533	430	363	316	175
99	1549	1108	882	741	642	568	459	387	337	187
* Experimental values for No. of Plates 5 - 33, extrapolated values for No. of Plates 39 - 99.										

Discharge Current Capacity Per Cell (Amps) **Cell Type: ICS-85**								**Final Volts - 1.94**		
No. Plates	1 Hr	2 Hr	3 Hr	4 Hr	5 Hr	6 Hr	8 Hr	10 Hr	12 Hr	24 Hr
7	84	62	50	42	36	32	26	22	19	11
9	112	83	66	56	48	43	35	29	26	14
11	140	103	83	69	60	54	43	37	32	18
13	168	124	99	83	72	64	52	44	38	21
15	196	144	116	97	84	75	61	51	45	25
17	224	165	133	111	96	86	69	59	51	28
19	252	185	149	125	108	96	78	66	57	32
21	280	206	166	139	120	107	86	73	64	35
23	308	227	182	153	132	118	95	81	70	39
25	336	247	199	166	144	128	104	88	76	42
27	364	268	215	180	156	139	112	95	83	46
29	392	288	232	194	168	150	121	103	89	49
31	420	309	249	208	180	160	130	110	96	53
33	448	329	265	222	192	171	138	117	102	56
39	504	371	298	250	216	193	156	132	115	63
45	588	432	348	291	252	225	182	154	134	74
51	672	494	398	333	288	257	207	176	153	84
57	756	556	447	374	324	289	233	198	172	95
63	840	617	497	416	360	321	259	220	191	106
69	924	679	547	457	396	353	285	242	210	116
75	1008	741	597	499	432	385	311	264	229	127
81	1092	802	646	541	468	417	337	286	248	137
87	1176	864	696	582	504	449	363	308	268	148
93	1260	926	746	624	540	481	389	330	287	158
99	1344	988	795	665	576	513	415	352	306	169
* Experimental values for No. of Plates 5 - 33, extrapolated values for No. of Plates 39 - 99.										

Discharge Power Capacity Per Cell (Watts) **Cell Type: ICS-75**									**Final Volts - 1.75**	
No. Plates	1 Hr	2 Hr	3 Hr	4 Hr	5 Hr	6 Hr	8 Hr	10 Hr	12 Hr	24 Hr
5	162	103	79	64	54	49	39	32	28	16
7	242	149	117	97	82	72	57	49	41	24
9	325	200	157	128	109	96	77	65	55	32
11	405	250	196	160	136	119	96	81	69	40
13	487	300	236	193	163	142	116	96	83	46
15	567	349	274	224	190	168	135	112	99	54
17	647	399	313	257	218	191	155	130	113	62
19	727	450	353	290	247	214	173	146	126	70
21	809	500	391	321	274	238	192	161	140	77
23	891	550	432	354	301	263	212	177	154	85
25	972	599	470	387	328	287	231	193	168	93
27	1052	649	508	417	355	310	251	211	182	101
29	1134	700	549	450	382	333	271	226	195	109
31	1214	750	587	483	410	359	288	242	209	117
33	1294	798	627	514	437	382	308	258	223	125

Discharge Power Capacity Per Cell (Watts) **Cell Type: ICS-75**									**Final Volts - 1.78**	
No. Plates	1 Hr	2 Hr	3 Hr	4 Hr	5 Hr	6 Hr	8 Hr	10 Hr	12 Hr	24 Hr
5	150	96	74	61	52	46	37	31	27	15
7	226	144	111	91	78	69	56	47	40	22
9	301	192	148	122	104	91	74	62	54	30
11	376	240	185	152	130	114	93	78	67	37
13	451	288	222	183	156	137	111	93	81	45
15	527	336	259	213	182	160	130	109	94	52
17	602	384	297	243	208	183	148	124	108	60
19	677	432	334	274	234	206	167	140	121	67
21	752	480	371	304	260	229	185	155	135	75
23	828	528	408	335	287	251	204	171	148	82
25	903	576	445	365	313	274	223	186	161	90
27	978	624	482	395	339	297	241	202	175	97
29	1053	672	519	426	365	320	260	217	188	104
31	1129	720	556	456	391	343	278	233	202	112
33	1204	768	593	487	417	366	297	248	215	119

Discharge Power Capacity Per Cell (Watts) **Cell Type: ICS-75**									**Final Volts - 1.81**	
No. Plates	1 Hr	2 Hr	3 Hr	4 Hr	5 Hr	6 Hr	8 Hr	10 Hr	12 Hr	24 Hr
5	144	94	73	60	51	45	37	31	27	15
7	217	141	110	90	77	68	55	46	40	22
9	289	188	146	120	103	91	74	62	53	30
11	361	235	183	151	129	113	92	77	67	37
13	433	282	219	181	154	136	110	93	80	45
15	506	330	256	211	180	159	129	108	93	52
17	578	377	292	241	206	181	147	123	107	59
19	650	424	329	271	232	204	166	139	120	67
21	722	471	365	301	257	227	184	154	133	74
23	795	518	402	331	283	249	202	170	147	82
25	867	565	438	361	309	272	221	185	160	89
27	939	612	475	391	335	295	239	200	173	96
29	1011	659	511	421	360	317	258	216	187	104
31	1084	706	548	451	386	340	276	231	200	111
33	1156	753	584	481	412	363	294	247	213	119

Discharge Power Capacity Per Cell (Watts) **Cell Type: ICS-75**									**Final Volts - 1.84**	
No. Plates	1 Hr	2 Hr	3 Hr	4 Hr	5 Hr	6 Hr	8 Hr	10 Hr	12 Hr	24 Hr
5	136	92	71	59	53	45	36	30	26	15
7	203	138	107	88	76	67	54	46	39	22
9	271	184	143	118	101	89	72	61	53	29
11	339	229	178	147	127	111	90	76	66	37
13	407	275	214	177	152	133	108	91	79	44
15	474	321	249	206	177	156	126	106	92	51
17	542	367	285	236	203	178	144	121	105	59
19	610	413	321	265	228	200	162	136	118	66
21	678	459	356	294	253	222	180	152	131	73
23	746	505	392	324	279	244	198	167	145	80
25	813	550	428	353	304	267	216	182	158	88
27	881	596	463	383	329	289	234	197	171	95
29	949	642	499	412	355	311	252	212	184	102
31	1017	688	535	442	380	333	270	227	197	110
33	1084	734	570	471	405	356	288	243	210	117

Discharge Power Capacity Per Cell (Watts) **Cell Type: ICS-75**									**Final Volts - 1.88**	
No. Plates	1 Hr	2 Hr	3 Hr	4 Hr	5 Hr	6 Hr	8 Hr	10 Hr	12 Hr	24 Hr
5	127	86	67	56	48	43	35	29	25	14
7	191	128	101	84	73	64	52	44	38	21
9	255	171	135	112	97	85	69	58	51	28
11	318	214	168	140	121	107	87	73	63	35
13	382	257	202	168	145	128	104	87	76	42
15	446	299	236	197	170	150	121	102	89	49
17	509	342	269	225	194	171	138	117	101	57
19	573	385	303	253	218	192	156	131	114	64
21	637	428	337	281	242	214	173	146	127	71
23	700	470	370	309	267	235	190	160	139	78
25	764	513	404	337	291	256	208	175	152	85
27	828	556	437	365	315	278	225	189	165	92
29	891	599	471	393	339	299	242	204	177	99
31	955	641	505	421	364	320	259	219	190	106
33	1019	684	538	449	388	342	277	233	202	113

Discharge Power Capacity Per Cell (Watts) **Cell Type: ICS-75**									**Final Volts - 1.90**	
No. Plates	1 Hr	2 Hr	3 Hr	4 Hr	5 Hr	6 Hr	8 Hr	10 Hr	12 Hr	24 Hr
5	114	80	64	54	46	41	33	28	25	14
7	171	120	95	80	70	62	50	42	37	21
9	228	160	127	107	93	82	67	56	49	28
11	285	200	159	134	116	103	83	70	62	35
13	342	240	191	161	139	123	100	84	74	41
15	399	280	223	187	162	144	117	99	86	48
17	457	320	255	214	185	165	133	113	98	55
19	514	360	286	241	209	185	150	127	111	62
21	571	400	318	268	232	206	167	141	123	69
23	628	440	350	294	255	226	183	155	135	76
25	685	480	382	321	278	247	200	169	148	83
27	742	520	414	348	301	267	217	183	160	90
29	799	560	445	375	325	288	234	197	172	97
31	856	600	477	401	348	309	250	211	185	103
33	913	640	509	428	371	329	267	225	197	110

Discharge Power Capacity Per Cell (Watts) **Cell Type: ICS-75**									**Final Volts - 1.94**	
No. Plates	1 Hr	2 Hr	3 Hr	4 Hr	5 Hr	6 Hr	8 Hr	10 Hr	12 Hr	24 Hr
5	102	71	57	48	42	37	30	26	22	13
7	153	107	85	72	63	56	46	39	34	19
9	204	143	114	96	84	75	61	52	45	25
11	255	178	142	120	105	93	76	65	56	31
13	306	214	170	143	126	112	91	77	67	38
15	357	250	199	167	147	130	106	90	79	44
17	408	285	227	191	167	149	121	103	90	50
19	459	321	256	215	188	168	137	116	101	57
21	510	356	284	239	209	186	152	129	112	63
23	561	392	313	263	230	205	167	142	123	69
25	612	428	341	287	251	224	182	155	135	76
27	663	463	369	311	272	242	197	168	146	82
29	715	499	398	335	293	261	213	181	157	88
31	766	535	426	359	314	279	228	194	168	94
33	817	570	455	382	335	298	243	206	180	101

Discharge Power Capacity Per Cell (Watts) **Cell Type: ICS-85**									**Final Volts - 1.75**	
No. Plates	1 Hr	2 Hr	3 Hr	4 Hr	5 Hr	6 Hr	8 Hr	10 Hr	12 Hr	24 Hr
7	259	170	131	107	91	80	64	54	47	26
9	345	226	175	143	122	106	86	72	62	35
11	432	283	218	179	152	133	107	90	78	43
13	518	339	262	215	182	159	129	108	93	52
15	604	396	306	250	213	186	150	126	109	61
17	690	453	349	286	243	212	171	144	125	69
19	777	509	393	322	274	239	193	162	140	78
21	863	566	437	358	304	266	214	180	156	87
23	949	622	480	393	334	292	236	198	171	95
25	1036	679	524	429	365	319	257	216	187	104
27	1122	735	567	465	395	345	279	234	202	113
29	1208	792	611	501	426	372	300	252	218	121
31	1295	848	655	536	456	398	321	270	234	130
33	1381	905	698	572	486	425	343	287	249	138
39	1553	1018	787	643	548	478	386	324	280	157
45	1812	1188	918	750	639	558	450	378	327	183
51	2071	1358	1049	857	730	638	514	432	374	209
57	2330	1527	1180	964	822	717	579	486	420	235
63	2589	1697	1311	1071	913	797	643	540	467	261
69	2847	1867	1443	1179	1004	877	707	594	514	288
75	3106	2037	1574	1286	1095	957	771	648	561	314
81	3365	2206	1705	1393	1187	1036	836	702	607	340
87	3624	2376	1836	1500	1278	1116	900	756	654	366
93	3883	2546	1967	1607	1369	1196	964	810	701	392
99	4142	2715	2098	1714	1461	1275	1029	864	747	418

Discharge Power Capacity Per Cell (Watts) **Cell Type: ICS-85**									**Final Volts - 1.78**	
No. Plates	1 Hr	2 Hr	3 Hr	4 Hr	5 Hr	6 Hr	8 Hr	10 Hr	12 Hr	24 Hr
7	249	165	128	105	90	79	64	53	46	26
9	332	220	171	141	120	105	85	71	62	34
11	415	274	213	176	150	131	107	89	77	43
13	498	329	256	211	180	158	128	107	93	51
15	581	384	299	246	210	184	149	125	108	60
17	664	439	341	281	240	210	171	142	124	69
19	747	494	384	316	270	236	192	160	139	77
21	830	548	427	351	299	263	213	178	155	86
23	913	603	469	386	329	289	234	196	170	94
25	996	658	512	421	359	315	256	213	185	103
27	1079	713	555	457	389	341	277	231	201	111
29	1162	768	597	492	419	368	298	249	216	120
31	1245	823	640	527	449	394	320	267	232	128
33	1328	877	683	562	479	420	341	285	247	137
39	1494	987	769	633	540	473	383	321	278	154
45	1743	1152	897	738	630	552	447	375	324	180
51	1992	1317	1025	843	720	631	511	429	370	206
57	2241	1481	1153	949	810	710	575	482	417	231
63	2490	1646	1281	1054	900	789	639	536	463	257
69	2739	1810	1410	1160	990	867	702	589	509	283
75	2988	1975	1538	1265	1080	946	766	643	555	309
81	3237	2139	1666	1371	1170	1025	830	696	602	334
87	3486	2304	1794	1476	1260	1104	894	750	648	360
93	3735	2469	1922	1581	1350	1183	958	804	694	386
99	3984	2633	2050	1687	1440	1262	1022	857	741	411

Discharge Power Capacity Per Cell (Watts) **Cell Type: ICS-85**								**Final Volts - 1.81**		
No. Plates	1 Hr	2 Hr	3 Hr	4 Hr	5 Hr	6 Hr	8 Hr	10 Hr	12 Hr	24 Hr
7	239	163	126	104	89	78	63	53	46	26
9	318	217	169	139	118	104	85	71	62	34
11	398	271	211	173	148	130	106	89	77	43
13	477	325	253	208	178	156	127	106	93	51
15	557	379	295	242	207	182	148	124	108	60
17	636	434	337	277	237	208	169	142	123	68
19	716	488	379	312	266	234	190	159	139	77
21	795	542	421	346	296	260	211	177	154	85
23	875	596	464	381	326	286	232	195	170	94
25	955	650	506	415	355	312	253	213	185	102
27	1034	704	548	450	385	338	275	230	200	111
29	1114	759	590	485	415	364	296	248	216	119
31	1193	813	632	519	444	390	317	266	231	128
33	1273	867	674	554	474	417	338	283	247	136
39	1432	975	759	622	532	468	381	319	278	154
45	1671	1137	885	726	621	546	444	372	324	180
51	1910	1299	1011	830	710	624	507	425	370	206
57	2148	1462	1138	933	798	702	571	478	417	231
63	2387	1624	1264	1037	887	780	634	531	463	257
69	2626	1787	1391	1141	976	858	698	585	509	283
75	2865	1949	1517	1245	1065	936	761	638	555	309
81	3103	2112	1644	1348	1153	1014	825	691	602	334
87	3342	2274	1770	1452	1242	1092	888	744	648	360
93	3581	2436	1896	1556	1331	1170	951	797	694	386
99	3819	2599	2023	1659	1419	1248	1015	850	741	411

Discharge Power Capacity Per Cell (Watts) **Cell Type: ICS-85**									**Final Volts - 1.84**	
No. Plates	1 Hr	2 Hr	3 Hr	4 Hr	5 Hr	6 Hr	8 Hr	10 Hr	12 Hr	24 Hr
7	230	157	123	102	87	77	62	52	45	25
9	306	210	164	136	116	102	83	70	60	34
11	383	262	205	169	145	128	103	87	75	42
13	459	314	246	203	174	153	124	104	91	51
15	536	367	287	237	203	179	145	122	106	59
17	612	419	327	271	232	204	165	139	121	67
19	689	471	368	305	261	230	186	157	136	76
21	765	524	409	339	290	255	207	174	151	84
23	842	576	450	372	319	281	227	191	166	93
25	918	628	491	406	349	306	248	209	181	101
27	995	680	532	440	378	332	269	226	196	110
29	1071	733	573	474	407	357	289	244	211	118
31	1148	785	614	508	436	383	310	261	226	126
33	1224	837	655	542	465	408	330	279	241	135
39	1378	944	738	609	522	460	373	314	273	152
45	1608	1101	861	711	609	537	435	366	318	177
51	1838	1258	984	813	696	614	497	418	363	202
57	2067	1416	1107	914	783	690	559	471	409	228
63	2297	1573	1230	1016	870	767	621	523	454	253
69	2527	1730	1353	1117	957	844	684	575	500	278
75	2757	1887	1476	1219	1044	921	746	627	545	303
81	2986	2045	1599	1320	1131	997	808	680	591	329
87	3216	2202	1722	1422	1218	1074	870	732	636	354
93	3446	2359	1845	1524	1305	1151	932	784	681	379
99	3675	2517	1968	1625	1392	1227	994	837	727	405

Discharge Power Capacity Per Cell (Watts) **Cell Type: ICS-85**									**Final Volts - 1.88**	
No. Plates	1 Hr	2 Hr	3 Hr	4 Hr	5 Hr	6 Hr	8 Hr	10 Hr	12 Hr	24 Hr
7	207	146	116	97	83	74	60	50	44	24
9	276	195	154	129	111	98	79	67	58	32
11	344	244	193	162	139	123	99	84	73	41
13	413	293	232	194	167	147	119	101	87	49
15	482	341	270	226	195	172	139	117	102	57
17	551	390	309	258	222	196	159	134	116	65
19	620	439	347	291	250	221	179	151	131	73
21	689	488	386	323	278	245	198	168	145	81
23	758	536	425	355	306	270	218	184	160	89
25	827	585	463	388	334	294	238	201	174	97
27	895	634	502	420	361	319	258	218	189	105
29	964	682	540	452	389	343	278	235	203	114
31	1033	731	579	484	417	368	297	251	218	122
33	1102	780	618	517	445	392	317	268	232	130
39	1239	877	694	581	501	442	357	301	262	147
45	1446	1023	810	678	585	516	417	351	306	171
51	1653	1169	926	775	669	590	477	401	350	195
57	1859	1315	1041	872	752	663	536	451	393	220
63	2066	1461	1157	969	836	737	596	501	437	244
69	2272	1608	1273	1065	919	811	655	552	481	269
75	2479	1754	1389	1162	1003	885	715	602	525	293
81	2685	1900	1504	1259	1086	958	774	652	568	318
87	2892	2046	1620	1356	1170	1032	834	702	612	342
93	3099	2192	1736	1453	1254	1106	894	752	656	366
99	3305	2338	1851	1550	1337	1179	953	802	699	391

Discharge Power Capacity Per Cell (Watts) **Cell Type: ICS-85**									**Final Volts - 1.90**	
No. Plates	1 Hr	2 Hr	3 Hr	4 Hr	5 Hr	6 Hr	8 Hr	10 Hr	12 Hr	24 Hr
7	188	136	109	92	80	71	57	49	42	24
9	250	181	145	122	106	95	77	65	57	32
11	313	226	181	153	133	118	96	81	71	39
13	376	271	217	183	160	142	115	97	85	47
15	438	316	254	214	186	165	134	114	99	55
17	501	361	290	245	213	189	153	130	113	63
19	563	407	326	275	239	213	172	146	127	71
21	626	452	362	306	266	236	192	162	141	79
23	689	497	398	336	293	260	211	178	155	87
25	751	542	435	367	319	283	230	195	169	95
27	814	587	471	397	346	307	249	211	184	103
29	876	632	507	428	372	331	268	227	198	110
31	939	677	543	459	399	354	287	243	212	118
33	1001	723	580	489	426	378	306	260	226	126
39	1126	813	653	550	478	424	345	293	255	141
45	1314	948	762	642	558	495	402	342	297	165
51	1502	1083	871	734	638	566	459	391	339	189
57	1689	1219	980	825	717	636	517	440	382	212
63	1877	1354	1089	917	797	707	574	489	424	236
69	2065	1490	1197	1009	877	778	632	537	467	259
75	2253	1625	1306	1101	957	849	689	586	509	283
81	2440	1761	1415	1192	1036	919	747	635	552	306
87	2628	1896	1524	1284	1116	990	804	684	594	330
93	2816	2031	1633	1376	1196	1061	861	733	636	354
99	3003	2167	1742	1467	1275	1131	919	782	679	377

Discharge Power Capacity Per Cell (Watts) **Cell Type: ICS-85**								**Final Volts - 1.94**		
No. Plates	1 Hr	2 Hr	3 Hr	4 Hr	5 Hr	6 Hr	8 Hr	10 Hr	12 Hr	24 Hr
7	165	122	99	83	72	64	52	44	39	21
9	220	163	132	110	96	86	70	59	52	29
11	275	204	165	138	120	107	87	74	64	36
13	330	244	198	166	144	129	104	89	77	43
15	385	285	231	193	168	150	122	104	90	50
17	440	326	264	221	192	172	139	118	103	57
19	495	367	297	248	216	193	157	133	116	64
21	550	407	330	276	240	215	174	148	129	71
23	605	448	363	304	264	236	192	163	142	79
25	660	489	395	331	288	257	209	178	155	86
27	715	529	428	359	312	279	226	192	168	93
29	769	570	461	386	336	300	244	207	180	100
31	824	611	494	414	360	322	261	222	193	107
33	879	652	527	442	384	343	279	237	206	114
39	990	733	594	496	432	386	314	267	231	129
45	1155	855	693	579	504	450	366	312	270	150
51	1320	977	792	662	576	514	418	357	309	171
57	1485	1099	891	744	648	579	471	401	347	193
63	1650	1221	990	827	720	643	523	446	386	214
69	1815	1344	1089	910	792	707	575	490	424	236
75	1980	1466	1188	993	864	771	627	535	463	257
81	2145	1588	1287	1075	936	836	680	579	501	279
87	2310	1710	1386	1158	1008	900	732	624	540	300
93	2475	1832	1485	1241	1080	964	784	669	579	321
99	2640	1954	1584	1323	1152	1029	837	713	617	343

10 Installation and Maintenance Record

The form in this section should be reproduced and used as the "Installation and Maintenance Record" for batteries. Refer to Section 8, *Maintenance,* for required actions and measurements.

Caution

Failure to adhere to the maintenance schedules and routines described in the *Maintenance* section of this product manual will void the product warranty and may result in reduced performance of your batteries.

The battery installer should follow the instructions in Section 6, "Unpacking and Handling" and "Installation Records," to begin the recordkeeping. **The installer should then turn these records over to the Maintenance organization, who becomes responsible for taking the measurements detailed in this section and for maintaining the form.** If a warranty claim is made, the Maintenance organization will be required to show the "Installation and Maintenance Record" to support the claim.

Refer to Section 8, *Maintenance,* for required actions and measurements.

Installation and Maintenance Record (Page 1)

Company Name: _____ Site Address: _____ Battery Type: _____

String Voltage: _____ Voltage across charge and discharge buses: _____ Voltage Difference: _____

If the voltage difference between the string and the charge/discharge buses is less than 0.05V, the system is ready. Make individual battery voltage measurements and record in the table below.

Voltage Measurements on Individual Batteries												
		Measurement Date										
		Initials										
Battery Number	Serial Number	Order Number										

Installation and Maintenance Record (Page 2)

Company Name: _____ Site Address: _____ Battery Type: _____

Temperature Measurements on Selected Batteries											
	Measurement Date										
Battery Number	Initials										

String Float Current Measurements											
	Measurement Date										
Battery Number	Initials										

Battery Capacity Measurements							
Test Date	Battery Temperature	Start Voltage (Vdc)	End Voltage (Vdc)	Test Current (A)	Test Start Time	Test End Time	Percent Capacity

Installation and Maintenance Record (Page 3)

Date	Comments

11 Material Safety Data Sheet

This section contains the Material Safety Data Sheet for the Unigy® II batteries.

ID: 11695

MATERIAL SAFETY DATA SHEET

Lucent Technologies
600 Mountain Avenue
Murray Hill, NJ 07974

Issue Date: 09/09/98
Issue Number: 3
Supersedes Date: 01/28/98

Non-Emergency Telephone # 908-582-3700
Emergency Telephone # 800-424-9300 (CHEMTREC)
Use CHEMTREC only in the event of chemical emergencies involving a spill, leak, fire, exposure, or accident involving chemicals.
Reason for Re-Issue: Update name, remove comcodes, change transportation data

I. PRODUCT IDENTIFICATION

Product Name: Battery, Unigy II Series WP-93379
Chemical Name/Synonym: WP-93379, Sealed, Rechargeable, Lead-acid Battery
HMDB Number: 11695
Label Codes
Health: 3 - Corrosive
Fire: 0 - Non-flammable
Reactivity: 1 - Slightly reactive

II. HAZARDOUS INGREDIENTS

Component	CAS #	%	TLV(ACGIH)	PEL(OSHA)
*Lead oxide	1317-36-8	20-25	.05 mg/m^3	.05 ug/m^3
*Lead	7439-92-1	43-70	.05 mg/m^3	.05 mg/m^3
*Lead sulfate	7446-14-2	N.D.	.05 mg/m^3	.05 mg/m^3
**Sulfuric acid	7664-93-9	20-44	1.0 $mg/m^{3,1}$	1.0 mg/m^3

[1]**STEL (ACGIH):** 3 mg/m^3 [1]**STEL (OSHA):** N/A

Comments: The data presented refer primarily to the acid electrolyte since this compound poses the predominant immediate hazard associated with this product. *These chemicals are subject to Section 313 Title III SARA Reporting Requirements. **This chemical in its existing form is not subject to Section 313 Title III Reportable Requirement. However, if the use of this product results in aerosol formation of this chemical, then the aerosol of this chemical is subject to SARA 313 Title III Reportable Requirements.

III. PHYSICAL PROPERTIES

Appearance/Odor: Acid electrolyte is clear with a strong acrid odor.
Specific Gravity: > 1.2
Boiling Point: ~ 235 °F
Vapor-Pressure: > 11.7 mm Hg at 68 °F
Evaporation Rate: < 1
% Volatiles by Volume: N/A
% Volatiles organic carbon: N/A
Vapor Density (Air=1): 3.4
Melting Point: N.D.
Solubility in Water: Soluble
pH: < 1

IV. HEALTH HAZARD SUMMARY

Primary Routes of Exposure

Oral: **Skin:** X **Eye:** X **Inhalation:** X

Effects of Overexposure:

None during normal conditions of use. The electrolyte is corrosive to skin, eyes, and mucous membranes. Repeated or prolonged inhalation of mists can cause inflammation of the upper respiratory tract and chronic bronchitis; pulmonary edema and death may occur from severe exposures. Early symptoms of lead intoxication include a persistent metallic taste, vomiting, diarrhea or constipation, and severe abdominal pain. Continued exposures may result in muscle weakness and fatigue, nerve system damage, paralysis, liver and kidney damage, anemia, anorexia, and adverse reproductive and developmental effects.

Listed as a Carcinogen or Potential Carcinogen By the Following Agencies?

NTP: No **IARC:** Yes **OSHA:** No

Toxicity Study Information:

Only selected Registry of Toxic Effects of Chemical Substances (RTECS) data are presented here. Consult latest issue for more information.

Sulfuric acid: The International Agency for Research on Cancer (IARC) has classified "strong inorganic acid mist containing sulfuric acid" as a Category I carcinogen, a substance that is carcinogenic to humans. This classification does not apply to liquid forms of sulfuric acid contained within a battery. Inorganic acid mist is not generated under normal use of this product. Misuse of the product such as overcharging, may result in the generation of sulfuric acid mist.

Lead-TC_{LO}: .01 mg/m^3, human, inhalation; TD_{LO}: 450 mg/kg/yr, human, oral. Reported to cause chromosomal aberrations in human and animal cells. Causes reproductive and developmental effects in experimental animals.

Lead sulfate-LD_{LO}: 2 g/kg, dog, oral; LD_{LO}: 30 g/kg, guinea pig, oral. Positive sister chromatid exchange assays in human and animal cells.

According to the International Agency for Research on Cancer (IARC) Monograph Supplement (1987), there is inadequate evidence for the carcinogenicity of lead in humans. Lead and inorganic lead compounds are classified as group 2B carcinogens by IARC. OSHA regulated (29 CFR 1910.1025).

The lead and lead sulfate contained in this product pose a minimal hazard because they are enclosed. A lead hazard may result during recycling or if battery is discarded improperly.

ID: 11695
Page 3 of 4

V. FIRST AID PROCEDURES

Eye: In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention immediately.

Skin: In case of contact, immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention immediately. Wash clothing before reuse.

Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Ingestion: If swallowed, do NOT induce vomiting. Give victim a glass of water. Call a physician immediately. Never give anything by mouth to an unconscious person.

Notes to physician: None

VI. FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A **Autoignition Temp:** N/A
Flammable Limits: LEL: N/A **UEL:** N/A

Extinguishing Media: For small fires use carbon dioxide, dry chemical. For large fires, flood area with large quantities of water, while suppressing vapors with waterfog/spray.

Special Firefighting Procedures: Cool battery exterior with water to prevent rupture. Firefighters should wear positive pressure self-contained breathing apparatus and thermal protective clothing to avoid toxic and corrosive mists, vapors, and possibly lead fumes.

Unusual Fire and Explosion Hazards: Sulfuric acid, especially when diluted with water, can react with metals to produce flammable gas. Remove all sources of ignition and ventilate area if battery is ruptured or recharging.

VII. REACTIVITY DATA

Stability: Stable

Conditions to Avoid: Prolonged overcharging; sources of ignition. Do not allow metallic articles to simultaneously contact the negative and positive terminals of the battery.

Incompatibility (Materials to Avoid): Combustibles, organic materials, strong oxidizers and reducing agents, strong acids and bases, active metals, water. Carbides, chlorates, nitrates, picrates, fulminates, halides, halogenates, peroxides, sulfides, potassium nitrate, nascent hydrogen.

Hazardous Decomposition Products:

Sulfuric acid: Sulfur oxides, sulfuric acid mist, hydrogen.

Lead: Presence of nascent hydrogen may generate highly toxic arsine gas.

Thermal decomposition of battery casing may produce nitrogen oxides and cyanides.

Hazardous Polymerization: Will not occur

Conditions to Avoid: None

VIII. SPECIAL PROTECTION INFORMATION

Ventilation: General ventilation should be adequate under normal conditions of use.

Respiratory Protection: Respirators are not required under normal conditions of use. Use NIOSH approved respirator for acid mist if PEL or TLV is exceeded when handling electrolyte.

Protective Gloves: Protective gloves are required if exposure to electrolyte is possible. Neoprene, rubber, or polyethylene types are suggested.

Eye Protection: Chemical splash goggles or full face shield is required if exposure to electrolyte is possible.

Other Clothing and/or Equipment: Eyewash and safety shower should be available for immediate use. Rubber boots and rubber apron in accordance with potential for electrolyte exposure. Long legged and long sleeved clothing.

IX. ENVIRONMENTAL INFORMATION

Steps to be Taken in Case Material is Released or Spilled: If an acid spill is external to the battery, cover the spill with clay or other recognized acid absorbing agent. Neutralize the acid with sodium bicarbonate (baking soda) or other recognized neutralizer. In an emergency sand, ashes, or gravel can be used to cover spill, and soda ash or lime used to neutralize acid; such substances should not be used on the battery itself as they can cause damage to it. Do not flush with water, even after acid has been neutralized.

Waste Disposal Method: Contains lead. Dispose of according to all applicable regulations.

TSCA Status: All components appear on the TSCA chemical substance inventory.

Shipping Information: USDOT/IATA: Name: Battery, Wet, Non-spillable **Class:** 8 **ID#:** UN2800 **PG:** III
This battery meets the DOT requirements for non-spillable batteries as specified in 49CFR173.159(d) and IATA requirements for non-spillable batteries as specified in packing instruction 806 and provision A67.

X. SPECIAL PRECAUTIONS

Storage and Handling Requirements: Store in a cool, dry, well ventilated area. Protect batteries from physical damage. All lead acid cells have enormous circuit capability. Extreme care should be exercised to avoid shorting of cell terminals. When working around cells remove rings, wrist watches, necklaces, metal bracelets, belt buckles, etc. Explosive hydrogen gas may be generated during charging.

N.D. = Not Determined **N/A** = Not Applicable.

12 Product Warranty

Unigy® II Batteries Product Warranty:

A. Seller warrants to customer that:

1. As of the date title to product sold (Product) passes, Seller will have the right to sell, transfer, and assign such product, and the title conveyed by Seller shall be good;

2. Upon shipment, Product will be free from defects in material and workmanship, and will conform to Seller's specification.

B. The Warranty periods and conditions applicable to new products are listed in Table 12-A:

Table 12-A: New Product Warranty Periods and Conditions

Warranted Life	Annual Average of Daily Maximum Battery Temperature (see Note)	Full Replacement	Pro-Rata Replacement
20 years	77°F (25°C)	2 years	18 years
10 years	90°F (32°C)	1 year	9 years
4 years	110°F (43°C)	0	4 years
1 year	122°F (50°C)	0	1 year

Note: Operating the Unigy® II battery for any length of time above 77°F (25°C) will result in reduced performance and premature failure. The battery may operate for a short period of time between 51°C and 65°C; however, operation or storage for any length of time above 122°F (50°C) will void the product warranty.

Temperature and maintenance records shall be maintained by Customer in accordance with Seller's published instructions in the *Maintenance* section of this manual. Failure to do so may void the warranty.

- End of life is defined as 80% of rated capacity (see *Operation* section for Discharge Capacity Test).
- Cycles and discharge depth shall not exceed:
  - 200 Cycles during Warranted years of life with an 80 percent discharge depth.

The Warranty Period commences on the date of shipment.

C. If, during the Warranty Period and under the Warranty Conditions, a defect or nonconformity is identified in a Product and Customer notifies Seller in writing of such defect or nonconformity, and follows Seller's instructions regarding return of defective or nonconforming Products, Seller shall, at its option, either replace such Product without charge or provide a credit as specified in the pro-rata replacement section of this warranty.

If notification of defect is:

- Within the years of the full replacement portion of the Warranty, Seller will, at its option, either replace the Product or provide a 100 percent credit based on the lesser of either current price or original purchase price. Credit will be applied to a replacement Lucent Technologies product.
- Within the years of the pro-rata replacement portion of the Warranty, Seller will, at its option, either replace the Product or provide a credit based on the following pro-rata formula: C = [(WR - ML)/WR] x PR

  where: C = Credit
  ML = Months of Life Obtained
  PR = Current Replacement Billing Price
  WR = Warranted Months of Life as determined in paragraph “B”.

  Credit will be applied to a replacement Lucent Technologies product.

D. If Seller has elected to replace a defective Product, the cost of removal and the reinstallation shall be borne by Customer. Products returned for replacement will be accepted by Seller only in accordance with its instructions for such returns. The

transportation expense and risk of loss associated with returning such Product to Seller shall be borne by Customer. Seller shall bear the cost of transportation and risk of loss of the replacing Product to the destination originally designated by Customer at time of purchase. When Seller has elected to replace Product or give credit, Product shall remain the Customer's property to be disposed of in accordance with Federal, State, and local regulations for hazardous materials.

E. If Seller determines that a Product for which warranty service is claimed is not defective or nonconforming, Customer shall pay or reimburse Seller for all costs of handling, inspecting, testing, disposal, and transportation, and, if applicable, traveling and related expenses.

F. Seller makes no warranty with respect to defective conditions or nonconformities resulting from actions of anyone other than Seller or its subcontractor, caused by any of the following: modifications, misuse, neglect, accident, or abuse; improper wiring, repairing, alteration, installation, storage, or maintenance; use in a manner not in accordance with Seller's specifications, or operating instructions, or failure of Customer to apply previously applicable Seller modifications and corrections. In addition, Seller makes no warranty with respect to Products which have had their serial numbers or month and year of manufacture removed or altered.

G. This warranty shall run only to Customer who is a direct purchaser from the Seller.

THE FOREGOING WARRANTIES ARE EXCLUSIVE AND IN LIEU OF ALL OTHER EXPRESS AND IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. CUSTOMER'S SOLE AND EXCLUSIVE REMEDY SHALL BE SELLER'S OBLIGATION TO REPLACE OR CREDIT AS SET FORTH PREVIOUSLY IN THIS WARRANTY.