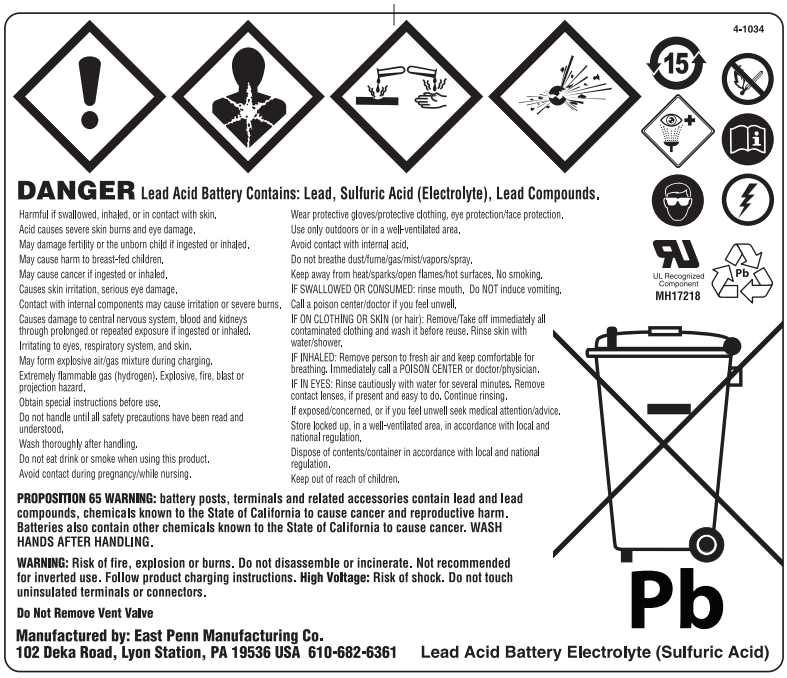
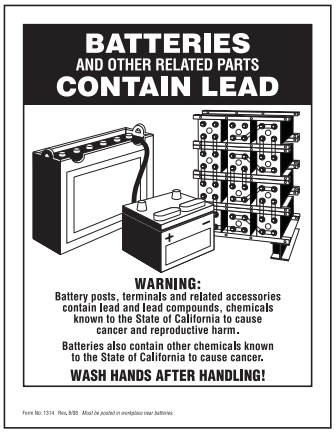
# 8A & 8G BATTERY INSTALLATION AND OPERATING INSTRUCTIONS

**This manual is intended to be a guide to optimize battery performance for multiple cyclic & float applications. Consult applicable User Manuals for additional parameters for specific systems. This manual is not intended for SLI or Vehicle related applications. Vehicle / Equipment Owner's Manual should be followed for SLI & Vehicle related applications.**




## IN REFERENCE TO THIS MANUAL:

- "Battery" is defined as an individual 12 or 6 volt unit.
- "Battery string" is defined as a series connected electrical system comprised of batteries (individual 12 or 6 volt units).

## SAFETY PRECAUTIONS

Although all valve-regulated cells have the electrolyte immobilized within the cell, the electrical hazards associated with batteries still exists. Work performed on these batteries should be done with the tools and the protective equipment listed below. VRLA battery installations should be supervised by personnel familiar with batteries and battery safety precautions.

WARNING: Risk of fire, explosion, or burns. Do not disassemble, heat above 40°C, or incinerate.

### Protective Equipment

Although VRLA batteries can vent or leak small amounts of electrolyte, electrical safety is the principle but not the only concern for safe handling. Per IEEE 1188 recommendations, the following minimum set of equipment for safe handling of the battery and protection of personnel shall be available:

- **Safety glasses with side shields, or goggles, or face shields as appropriate. (Consult application specific requirements)**
- Electrically insulated gloves, appropriate for the installation.
- Protective aprons and safety shoes
- Portable or stationary water facilities in the battery vicinity for rinsing eyes and skin in case of contact with acid electrolyte.

## SAFETY PRECAUTIONS *(con't)*

- Class C fire extinguisher
- Acid neutralizing agent.
- Adequately insulated tools (as defined by ASTM F1505 "Standard Specification for Insulated and Insulating Hand Tools").
- Lifting devices of adequate capacity, when required.

### Procedures

**Consult User Manual of specific application for additional Safety & Operating requirements.**

The following safety procedures should be followed during installation: **(Always wear safety glasses with side shields or face shield goggles when working on or near batteries.)**

1. These batteries are sealed and contain no free electrolyte. Under normal operating conditions, they do not present any acid danger. However, if the battery jar or cover is damaged, acid could be present. **Sulfuric acid is harmful to the skin and eyes. Flush affected area with water immediately and consult a physician if splashed in the eyes. Consult SDS for additional precautions and first aid measures.**

   **Consult SDS for additional precautions and first aid measures.**

   **SDS sheets can be obtained at www.eastpennmanufacturing.com**
2. **Prohibit smoking and open flames, and avoid arcing in the immediate vicinity of the battery.**

## SAFETY PRECAUTIONS *(con't)*

3. Do not wear metallic objects, such as jewelry, while working on batteries. Do not store un-insulated tools in pockets or tool belt while working in vicinity of battery.
4. Keep the top of the battery dry and clear of all tools and other foreign objects.
5. Provide adequate ventilation **(per IEEE standard 1187 and / or as regulated by Federal, State and Local codes)** and follow recommended charging voltages.
6. **Never** remove or tamper with pressure relief valves. Warranty void if vent valve is removed.
7. Inspect all flooring and lifting equipment for functional adequacy.
8. Adequately secure battery, racks or cabinets to the floor.
9. Connect support structures to ground system in accordance with applicable codes.

## RECEIVING & STORAGE

### Receiving Inspection

Upon receipt, and at the time of unloading, each package should be visually inspected for any possible damage or electrolyte leakage. If either, the entire shipment should be conducted and noted on the bill of lading. Record receipt date, inspection date and notify carrier of any damage.

Original packaging should remain on battery during storage and transportation to prevent damage to the battery or short circuit of the terminals.

### Unpacking

1. **Always wear eye protection**
2. Check all batteries for visible defects such as cracked containers, loose terminals posts, or other unrepairable problems. Batteries with these defects must be replaced.
3. Check the contents of the packaging against the packaging list. Report any missing parts or shipping damage to your East Penn agent or East Penn Mfg. Co. immediately.
4. Never lift batteries by the terminal posts.

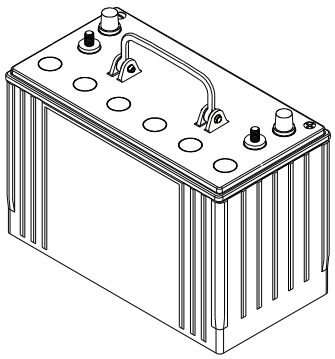
### Storage / Refresh

Batteries should be installed and placed on charge upon delivery. If batteries are to be stored, the below requirements shall be followed.

1. Batteries shall be stored indoors in a clean, level, dry, cool location.
2. Store, charge and ship in vertical position only.
3. Battery pallets shall not be double stacked, or equipment stored on top.
4. Recommended storage temperature is 50°F (10°C) to 77°F (25°C). Acceptable storage temperature is 0°F (-18°C) to 90°F (32°C).
5. The batteries shall be given a refresh charge at regular intervals as detailed below:
   **0°F (-18°C) to 77°F (25°C)**
   Batteries shall be charged by the "battery charge date" marked on the pallet. Successive recharges shall be performed every 6 months.
   **78°F (26°C) to 90°F (32°C)**
   Battery voltage readings shall be taken monthly. Batteries must be given a refresh charge within 3 months from date of receipt or if any battery voltage falls below 12.72 volts per battery (6.36V for 6V battery). Successive refresh charges shall be performed every 3 months.
6. Whenever a refresh charge is required, it's important that all batteries to be installed in the same series string receive a charge at the same time to ensure continuity once placed in their intended application.
7. Each battery shall be charged for 24 hours at a constant voltage equal to 14.40 volts per battery (7.20V for 6V battery). To ensure the batteries are fully charged within 24 hrs, the charger used for the refresh charge must have the capacity to provide at least the minimum charge current specification and not exceed the maximum charge current for the given battery type (model), as called out in Appendix D.
8. All requested information on "Refresh Record Form" in Appendix A should be completed for each refresh charge.
9. Batteries shall not be stored beyond 12 months. Storing beyond 12 months will affect warranty.
10. If the storage / refresh requirements cannot be met, contact the East Penn agent or East Penn Mfg. Co. for alternative instructions.

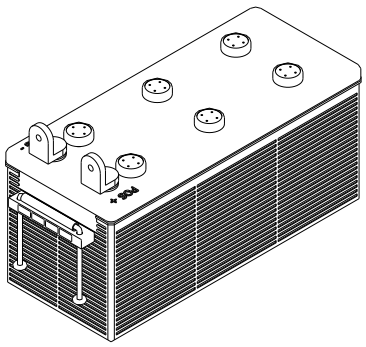
**DEKA 8A & 8G BATTERIES ARE TESTED AND APPROVED TO BE INSTALLED AND OPERATED IN THEIR UPRIGHT POSITION.**

**TOP TERMINAL BATTERY**



**Terminals – Upright Position**

**FRONT TERMINAL BATTERY**



**Terminals – Upright / Front Position**

**FOR ANY OTHER INSTALLATION ORIENTATION, THE PRODUCT WILL NOT BE WARRANTED.**

# INSTALLATION

## General

Caution should be taken when installing batteries to ensure no damage occurs. The battery string cabinet, tray, rack, etc. shall be inspected for sharp edges that could cause damage to the battery casing. Batteries shall not be dropped, slid or placed on rough or uneven surfaces such as tray lips or graded flooring. Mishandling of batteries could result in equipment damage or human injury. East Penn will not be liable for damage or injury as a result of mishandling or misuse of the product.
NOTE: If battery monitoring system is installed prior to battery being placed in service, monitoring system should remain off to prevent discharging of battery."

## Electrical Connections

When making electrical connections to the battery string, proper techniques should be applied per electrical standards such as NEC and/or Federal, State and Local codes, as well as User Manual of specific applications.

## Grounding

When grounding the battery string, proper techniques should be applied per electrical standards such as NEC and/or Federal, State and Local codes, as well as User Manual of specific applications.

## Cabinets

Cabinet systems may come assembled and prewired. Do not tip or turn cabinets on their sides when positioning them in their intended position. These systems may be pre-connected. Only inter-shelf, inter-cabinet and connections to the load are required. Consult the connection diagram inside the cabinet. Typically, inter-cabinet and load connection cables are not included.

## Racks

Assemble racks in accordance with the intended arrangement, align with a level and bolt to the floor. Consult rack assembly instructions.

## Venting

Under normal operation, VRLA batteries emit hydrogen gas, which is combustible at certain concentrations. Proper ventilation should be provided per IEEE 1187 and/or local codes. Ventilation equipment is not designed orsupplied by East Penn Mfg. Safe installation of any venting equipment is the responsibility of the installer.

# BATTERY ASSEMBLY

**(Always wear eye protection.)**

1. Set up battery string so that the positive post (+) of one battery is connected to the negative post (-) of the next battery for all series connections. The interbattery connector contact surfaces shall be cleaned by rubbing gently with a non-metallic brush or pad beforeinstalling connectors / cables.
   **Only approved oxide inhibitors (No-Ox-ID "A" from Sanchem, Inc.) may be applied to the connections and battery posts.**
2. For future identification, individual batteries should be numbered in electrical connection sequence, beginning with number one (1) at the positive end of the battery string.
3. All battery electrical contact surfaces shall be cleaned by rubbing gently with a non-metallic brush or pad before installing connectors. Oxide inhibitor grease can be used but is not required. Only approved oxide inhibitor: No-Ox-ID "A" from Sanchem, Inc. should be used on terminals and connectors.
4. Install all electrical connectors / cables and bolting hardware loosely to allow for final alignment of batteries. Torque to manufacturer recommendations.
5. After torquing, read the voltage of the battery string to ensure the individual batteries are connected correctly. The total voltage should be approximately equal to the number of batteries times the measured voltage of one battery (when connected in series). If the measurement is less, recheck the connections for proper voltage and polarity.
6. Read and record connection resistance and note the method of measurement. This helps determine a satisfactory initial installation and can be used as a reference for future maintenance requirements. **See Appendix E,** recording forms, in the back of the manual. **Clean, remake and remeasure any connection having a resistance measurement greater than 10% of the average of all the same type of connections.**
7. Battery string performance is based on the output at the battery terminals. Therefore, the shortest electrical connections between the battery string and the operating equipment results in maximum total system performance.
   Do not select cable size on current carrying capability only. Cable size should not provide a greater voltage drop between the battery string and operating equipment than specified. Excess voltage drop will reduce the desired support time of the battery string**.**

# SYSTEM OPERATION

| State of Charge vs. Open Circuit Voltage* | | |
|---|---|---|
| % Charge | Gel | AGM |
| 100 | 12.85 or higher | 12.80 or higher |
| 75 | 12.65 | 12.60 |
| 50 | 12.35 | 12.30 |
| 25 | 12.00 | 12.00 |
| 0 | 11.80 | 11.80 |

## State of Charge

Battery state of charge can be determined by measuring the open circuit voltage. Consult the below table.

**NOTE: Divide values in half for 6-volt battery(ies)**

**The "true" O.C.V. of a battery can only be determined after the battery has been removed from the load (charge / discharge) for 24 hours.*

# SYSTEM OPERATION *(con't)*

## Charging

**Consult Charger User Manual of specific application for Safety and Operating requirements.**
For cyclic applications it is important that the battery(ies) be charged fully after each discharge. It is recommended that 108% to 115% of the Ah (Amp Hour) capacity removed from the battery(ies) be replaced after each
discharge. This additional Ah is to compensate for any efficiency losses between the battery charger and the battery(ies)

## Charge Voltage

For both 8A & 8G batteries the following voltage settings should be followed:

**Charge / Absorption / Equalize**

13.80V to 14.60V @ 77°F (25°C)

**Float / Standby**

13.50V +/- 0.5% @ 77F (25°C)

The charger must be able to maintain the battery string voltage within ± 0.5% of the desired level at all times.

**Note: Divide values in half for 6-volt battery(ies).**

# TEMPERATURE COMPENSATION

Battery voltage should be adjusted for ambient temperature variations.

3mV per °C (1.8°F) per cell
18mV per 12V battery
9mV per 6V battery

For temperatures above 77°F (25°C) subtract and for temperatures below 77°F (25°C) add.

Consult **Voltage Compensation Chart in Appendix B** for temperature compensation voltage maximum and minimum limits.
The average battery operating temperature should not exceed 95°F (35°C) and should never exceed 105°F (40.5°C) for more than an eight-hour period. Operating at temperatures greater than 77°F (25°C) will reduce the operating life of the battery. **If operating temperatures are expected to be in excess of 95°F (35°C), contact East Penn for recommendations.**
Discharging at temperatures less than 77°F (25°C) will reduce the capacity of the battery.

## Charge Current

To properly determine the amount of charge current required the following variables are to be considered:

- DoD (Depth of Discharge)
- Temperature
- Size & efficiency of the charger
- Age and condition of battery(ies)

Maximum charge current should be limited to 30% of the C20 Ah rate for the battery(ies) being used in the battery string.

**Example:** 8G24 C20 rate – 73.6Ah
Max. recharge rate: 73.6Ah x 0.3 = 22.1A

Consult **Charging Current vs Charging Time chart in Appendix C** as a guide line to determine recharge time from 0% to 90% state of charge at an initial charge current.

# TEMPERATURE COMPENSATION *(con't)*

## Discharge Voltage Curve

To estimate battery voltage during a constant current discharge at various DoD (Depth of Discharge) consult chart **Discharge Voltage Curve in Appendix B.**

**NOTE: Battery voltage can vary depending on temperature, age, and condition of battery.**

# BATTERY OPERATION

Battery operating temperature will effect battery string capacity and operating life.

Temperatures greater than 77°F (25°C) will reduce the operating life of the battery. For every 13°F (7°C) increase in operating temperature above 77°F (25°C), the warranty period will be proportionally reduced by 50% as shown below:

| Operating Temperature | | Proportional Percentage (%) of Life |
|---|---|---|
| °F | °C | |
| 77 | 25 | 100% |
| 81 | 27 | 80% |
| 87 | 30 | 60% |
| 90 | 32 | 50% |

The average cell operating temperature should not exceed 95°F (35°C) and should never exceed 105°F (40.5°C) for more than an eight-hour period. **If operating temperatures are expected to be in excess of 95°F (35°C), contact East Penn for recommendations.**

Discharging at temperatures less than 77°F (25°C) will reduce the capacity of the battery.
Batteries [cells] must not be continuously operated below 50°F (10°C). **If operating temperatures are expected to be less than 50°F (10°C), contact East Penn for recommendations.**

The battery string must be located in a manner that the individual cells do not vary by more than 5°F (2.8°C) between the lowest and highest individual cell temperatures.

# RECTIFIER RIPPLE VOLTAGE

## Frequency

Ripple that has a frequency greater than 667Hz (duration less than 1.5ms) is acceptable, unless it is causing additional battery heating.

Ripple that has a frequency less than 667Hz (duration greater than1.5ms), must meet the following voltage specification to be acceptable.

## Voltage Specification

Ripple voltage shall be less than .5% peak to peak of the manufacturer's recommended string voltage.

Failure to comply can void the warranty.

# RECORD KEEPING

## Voltages, Temperatures & Ohmic Readings

Record keeping is an important part of battery maintenance and warranty coverage. This information will help in establishing a life history of the battery string and inform the user if and when corrective action needs to be taken. Consult Battery Maintenance Report (Pg.8 – Appendix E).

While it is acceptable to operate at temperatures less than 77°F (25°C), it will require longer charging time to become fully recharged. Also, the capacity will be less at operating temperatures below 77°F (25°C).

After installation and when the battery string has been on float charge for one week, the following data should be recorded:

1. Battery string voltage at battery terminals while battery is on float charge.
2. Charger voltage at charger panel meter.
3. Individual battery float voltages.
4. Ambient temperatures within area of battery string.
5. Terminal connections should be checked to verify that the installer did torque all connections are properly torqued. Micro-ohm readings should be taken across every
connection. Refer to meter manufacturer's instructions for proper placement of probes. If any reading differs by more than **20%** from its initial installation value, re-torque the connection, to **100 ± 5 in lb (11.3 ± .5 newton meters)** for proper torque values. **If reading remains high, clean contact surfaces according to Step 2 under Battery Assembly.**

**Failure to maintain proper records including information as detailed above may result in voiding any applicable warranty.**

## Acceptance Testing

Each battery should be at 100% State of Charge prior to performing an acceptance test on the battery system. To ensure the batteries are fully charged the following charge schedule should be followed.

Batteries should be charged at the equalization rate of 14.40 volts per battery (7.20V for 6V battery) for 24 hours. Temperature compensated charging parameters shall be applied as detailed in "Voltage Compensation Chart" in Appendix B of this manual.

To ensure the batteries are fully charged within 24hrs; the charger used for this charge must have the current equal to the maximum charge current for the given battery type (model), as called out in Appendix D of this manual.

If these requirements cannot be met, contact East Penn Reserve Power's Product Support group for alternate instructions.

Upon completion, the charge voltage should be lowered to the float voltage of 13.50 volts per battery (6.75V for 6V battery) for a minimum period of 72 hours. Reference: IEEE 1188-2005 Section 7.2 for additional acceptance test requirements.

Upon completion of the above charge, the desired acceptance test can be performed.

NOTE: There shall be no discharges of any duration between the start of the equalization and the completion of the float period. If a discharge does occur, the charging regime detailed above shall be repeated.

Upon completion of the acceptance test, the battery system should be placed on float charge at 13.50 volts per battery (6.75V for 6V battery) to restore the battery to its' rated capacity. Batteries should not require an equalization charge once they have passed their initial acceptance test. Consult with East Penn Reserve Power's Product Support group before performing additional equalizing charges on batteries that have successfully passed their initial acceptance test.

# MAINTENANCE

Always wear eye protection when working on or near batteries. Keep sparks and open flames away from batteries at all times.
**Consult User Manual of specific application for additional Safety & Operating requirements.**

## Annual Inspection

Depending on the application, some of the following recommendations may not apply.

1. Conduct a visual inspection of the battery(ies).
2. Record battery and /or battery string voltage. The accuracy of the DMM (Digital Multimeter) must be 0.05% (on dc scale) or better. The DMM must be calibrated to NIST traceable standards. Because voltage readings are affected by discharge and recharges, for cyclic applications, the battery(ies) must be in a fully charged condition prior to taking readings. Batteries should be within ± 0.30 volts (+ 0.15 volts for 6V) of the average battery float voltage.
3. Record charger voltage at charger panel meter.
4. Record the ambient temperature.
5. Record the battery string temperature at the negative terminal
6. Record individual battery ohmic readings.***
7. Record all interunit and terminal connection resistances. Micro-ohm readings should be taken during this inspection. If any reading is greater than 20% from initial readings, retorque the connection. Recheck the micro-ohm reading. If the reading remains high, clean contact surface according to installation portion of this manual.

***** Note: To provide accurate / consistent values, battery(ies) must be fully charged, at same temperature and probes placed at same location each time readings are taken.**

## Battery Cleaning

Batteries, cabinets, and racks should be cleaned with clean water, a mixture of baking soda and water or East Penn Mfg. supplied battery cleaner (part # 00321

**Never use solvents to clean the battery(ies).**

## Capacity Testing

Capacity testing is used to trend battery aging. The result of a capacity test is a calculation of the capacity of the battery. The calculated capacity is also used to determine if the battery requires replacement.

**NOTE: When discharging at higher rates, extra connectors may need to be added to prevent excessive voltage drop and / or excessive temperature rise.**

Should it be determined any individual battery(ies) or cell(s) need to be replaced, contact your nearest East Penn agent or East Penn Mfg. Co.

# APPENDIX A

## REFRESH RECORD FORM

Rev. 1
5-11-2024

EASTPENN

| EPM Order Number* | Pallet ID Number | Individual Performing Test (Full Name) | Date of Refresh | Refresh Duration |
|---|---|---|---|---|
| | | | | |

| | Information Prior to Refresh | | | Readings to be taken 1 hour before the completion of Refresh charging | | | |
|---|---|---|---|---|---|---|---|
| Model Number | Date Code | Battery Serial Number | Open Circuit Voltage | Battery Voltage Reading | Charging Current | Battery Temperature | Notes & Comments |
| | | | | | | | |
| Battery 1 | | | | | | | |
| Battery 2 | | | | | | | |
| Battery 3 | | | | | | | |
| Battery 4 | | | | | | | |
| Battery 5 | | | | | | | |
| Battery 6 | | | | | | | |
| Battery 7 | | | | | | | |
| Battery 8 | | | | | | | |
| Battery 9 | | | | | | | |
| Battery 10 | | | | | | | |
| Battery 11 | | | | | | | |
| Battery 12 | | | | | | | |
| Battery 13 | | | | | | | |
| Battery 14 | | | | | | | |
| Battery 15 | | | | | | | |
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| Battery 34 | | | | | | | |
| Battery 35 | | | | | | | |
| Battery 36 | | | | | | | |
| Battery 37 | | | | | | | |
| Battery 38 | | | | | | | |
| Battery 39 | | | | | | | |
| Battery 40 | | | | | | | |

**ALL FIELDS TO THE RIGHT OF THE JAR NUMBER ABOVE MUST BE COMPLETED**

EPM ORDER NUMBER WILL APPEAR ON THE SHIPPING LABEL ON THE CARTON COVERING EACH PALLET OF Batteries(if applicable)

TO ENSURE CONTINUATION OF WARRANTY, SUBMIT FORMS TO: East Penn Mfg. Co, Inc., Reserve Power Division, Product Support & Warranty Dept. (reservepowerwarranty@dekabatteries.com)

Electronic version of form can be obtainded by contacting East Penn Mfg. Co, Inc., Reserve Power Division, Product Support & Warranty Dept. (reservepowerwarranty@dekabatteries.com)

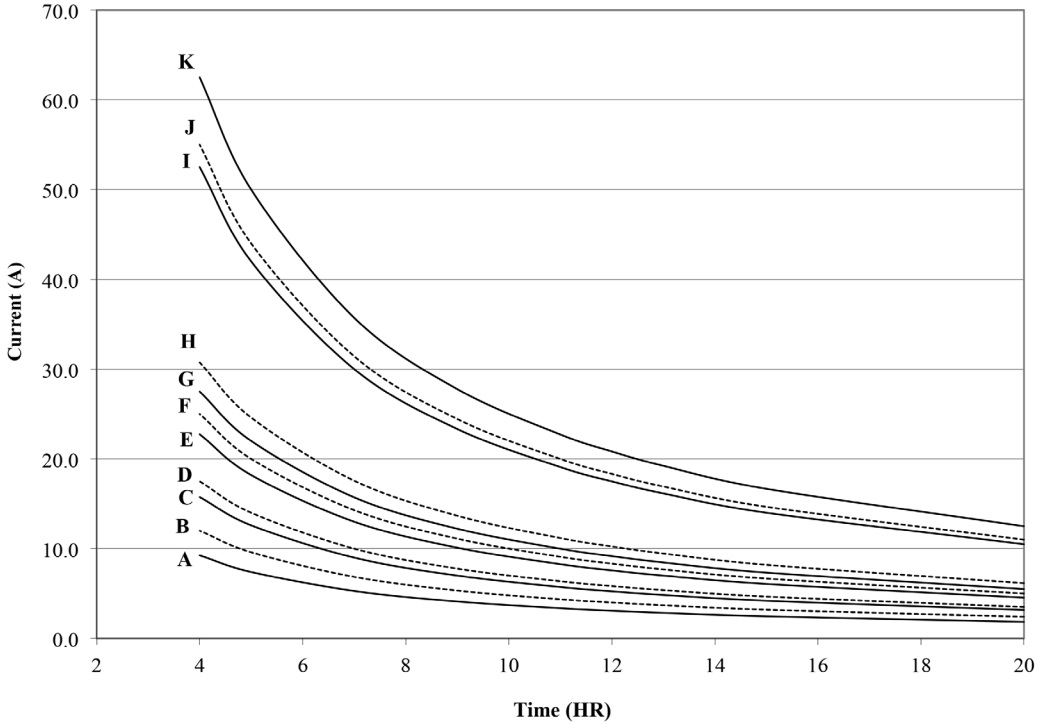
## Voltage Compensation Chart

| °C | Float | Absorption / Regulation | | Equalize / Maintenance | °F |
|---|---|---|---|---|---|
| | | Min. | Max. | | |
| >35 | 13.32 | 13.62 | 14.22 | 14.40 | >95 |
| 34 | 13.34 | 13.64 | 14.24 | 14.42 | 93.2 |
| 33 | 13.36 | 13.66 | 14.26 | 14.44 | 91.4 |
| 32 | 13.37 | 13.67 | 14.27 | 14.45 | 89.6 |
| 31 | 13.39 | 13.69 | 14.29 | 14.47 | 87.8 |
| 30 | 13.41 | 13.71 | 14.31 | 14.49 | 86.0 |
| 29 | 13.43 | 13.73 | 14.33 | 14.51 | 84.2 |
| 28 | 13.45 | 13.75 | 14.35 | 14.53 | 82.4 |
| 27 | 13.46 | 13.76 | 14.36 | 14.54 | 80.6 |
| 26 | 13.48 | 13.78 | 14.38 | 14.56 | 78.8 |
| **25** | **13.50** | **13.80** | **14.40** | **14.58** | **77.0** |
| 24 | 13.52 | 13.82 | 14.42 | 14.60 | 75.2 |
| 23 | 13.54 | 13.84 | 14.44 | 14.62 | 73.4 |
| 22 | 13.55 | 13.85 | 14.45 | 14.63 | 71.6 |
| 21 | 13.57 | 13.87 | 14.47 | 14.65 | 69.8 |
| 20 | 13.59 | 13.89 | 14.49 | 14.67 | 68.0 |
| 19 | 13.61 | 13.91 | 14.51 | 14.69 | 66.2 |
| 18 | 13.63 | 13.93 | 14.53 | 14.71 | 64.4 |
| 17 | 13.64 | 13.94 | 14.54 | 14.72 | 62.6 |
| 16 | 13.66 | 13.96 | 14.56 | 14.74 | 60.8 |
| 15 | 13.68 | 13.98 | 14.58 | 14.76 | 59.0 |
| 14 | 13.70 | 14.00 | 14.60 | 14.78 | 57.2 |
| 13 | 13.72 | 14.02 | 14.62 | 14.80 | 55.4 |
| 12 | 13.73 | 14.03 | 14.63 | 14.81 | 53.6 |
| 11 | 13.75 | 14.05 | 14.65 | 14.83 | 51.8 |
| <10 | 13.77 | 14.07 | 14.67 | 14.85 | <50 |

**Note: 1. Above values based on 12-volt battery.**
**2. Divide above values in half for 6-volt battery.**

# APPENDIX C

## CHARGING CURRENT VS. CHARGING TIME*

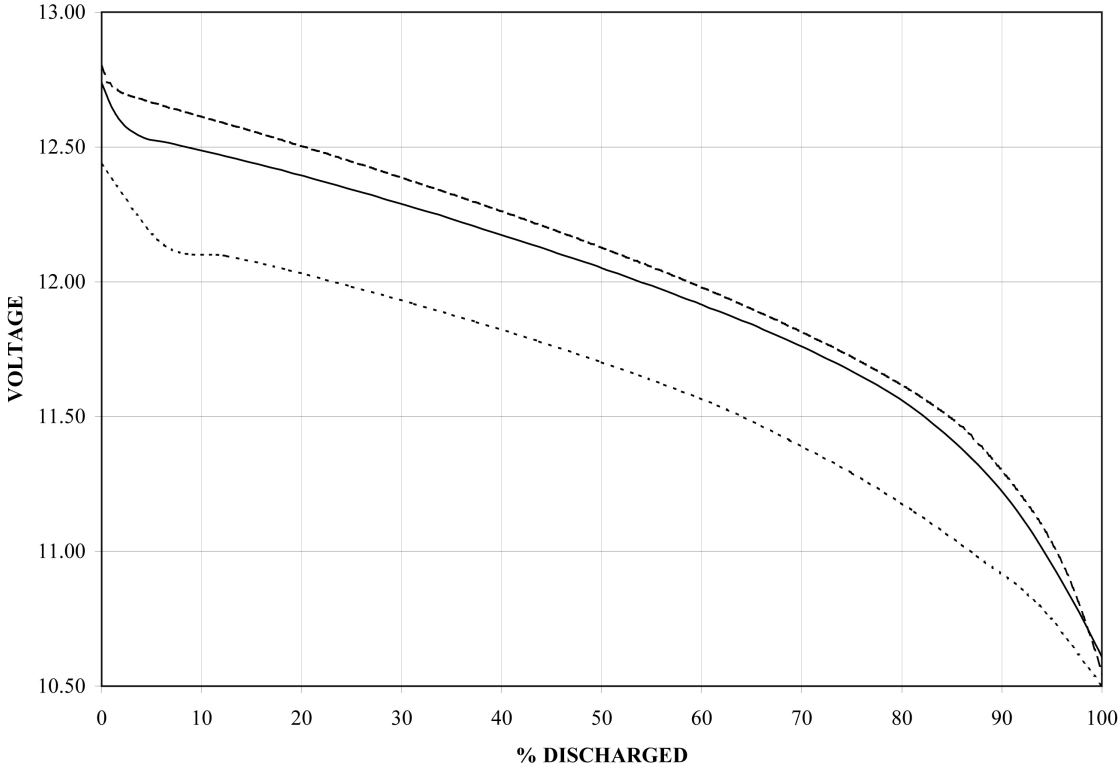



**BATTERY TYPE**

**A** = 8AU1, 8GU1
**B** = 8G40C
**C** = 8A22NF, 8G22NF
**D** = 8G34R
**F** = 8A27, 8G27
**G** = 8A31DT, 8G30H, 8G31, 8G31DT
**H** = 8G5SHP
**I** = 8A4D, 8G4D, 8GTE35
**J** = 8A8D, 8G8D
**K** = 8AGC2, 8GGC2

*** Above values are to 90% SOC (State of Charge) based on C100 Ah capacity**

## DISCHARGE VOLTAGE CURVE



# Charge Current Limits

## 8A Series

| Cell Type | Max. Charge Current (A) | Min. Charge Current (A)** |
|---|---|---|
| **8AU1** | 9.6 | 2.9 |
| **8A22NF** | 16.5 | 5.0 |
| **8A24** | 23.7 | 7.1 |
| **8A24HEI** | 23.7 | 7.1 |
| **8A27** | 27.6 | 8.3 |
| **8A27EI** | 27.6 | 8.3 |
| **8A30H** | 31.5 | 9.5 |
| **8A30HEI** | 31.5 | 9.5 |
| **8A31DT** | 31.5 | 9.5 |
| **8AGC2** | 57.0 | 17.1 |
| **8A4D** | 59.4 | 17.8 |
| **8A8D** | 73.5 | 22.1 |

** = Using minimum charge current will extend recharge time and increase risk of battery being undercharged

## 8G Series

| Cell Type | Max. Charge Current (A) | Min. Charge Current (A)** |
|---|---|---|
| **8GU1** | 9.5 | 2.8 |
| **8G40C** | 12.0 | 3.6 |
| **8G22NF** | 15.3 | 4.6 |
| **8G34R** | 18.0 | 5.4 |
| **8G24** | 22.1 | 6.6 |
| **8G24SS** | 22.1 | 6.6 |
| **8G27** | 26.4 | 7.9 |
| **8G30H** | 29.3 | 8.8 |
| **8G31** | 29.3 | 8.8 |
| **8G31DT** | 29.3 | 8.8 |
| **8GGC2** | 54 | 16.2 |
| **8G4D** | 55 | 16.5 |
| **8G4DEI** | 55 | 16.5 |
| **8G8D** | 68 | 20.3 |
| **8G8DEI** | 68 | 20.3 |
| **8G5SHP** | 34 | 10.3 |
| **8GTE35** | 59 | 17.7 |

** = Using minimum charge current will extend recharge time and increase risk of battery being undercharged

## APPENDIX E

# BATTERY MAINTENANCE REPORT

Inspection Date_____ No. of Units/String _____

Company _____ Type _____

Address _____ Date New _____

Battery location and/or number _____ Date Installed _____

### *Individual Battery Readings*

Charger Output _____Amp Air Temperature_____°F

Total Battery String Voltage _____ Panel Meter Volts _____

| Year _____ | | | Year _____ | | | Year _____ | | | Year _____ | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unit Number | Volts | Ohms or Mhos | Unit Number | Volts | Ohms or Mhos | Unit Number | Volts | Ohms or Mhos | Unit Number | Volts | Ohms or Mhos |
| 1 | | | 1 | | | 1 | | | 1 | | |
| 2 | | | 2 | | | 2 | | | 2 | | |
| 3 | | | 3 | | | 3 | | | 3 | | |
| 4 | | | 4 | | | 4 | | | 4 | | |
| 5 | | | 5 | | | 5 | | | 5 | | |
| 6 | | | 6 | | | 6 | | | 6 | | |
| 7 | | | 7 | | | 7 | | | 7 | | |
| 8 | | | 8 | | | 8 | | | 8 | | |
| 9 | | | 9 | | | 9 | | | 9 | | |
| 10 | | | 10 | | | 10 | | | 10 | | |
| 11 | | | 11 | | | 11 | | | 11 | | |
| 12 | | | 12 | | | 12 | | | 12 | | |
| 13 | | | 13 | | | 13 | | | 13 | | |
| 14 | | | 14 | | | 14 | | | 14 | | |
| 15 | | | 15 | | | 15 | | | 15 | | |
| 16 | | | 16 | | | 16 | | | 16 | | |
| 17 | | | 17 | | | 17 | | | 17 | | |
| 18 | | | 18 | | | 18 | | | 18 | | |
| 19 | | | 19 | | | 19 | | | 19 | | |
| 20 | | | 20 | | | 20 | | | 20 | | |
| 21 | | | 21 | | | 21 | | | 21 | | |
| 22 | | | 22 | | | 22 | | | 22 | | |
| 23 | | | 23 | | | 23 | | | 23 | | |
| 24 | | | 24 | | | 24 | | | 24 | | |
| 25 | | | 25 | | | 25 | | | 25 | | |
| 26 | | | 26 | | | 26 | | | 26 | | |
| 27 | | | 27 | | | 27 | | | 27 | | |
| 28 | | | 28 | | | 28 | | | 28 | | |
| 29 | | | 29 | | | 29 | | | 29 | | |
| 30 | | | 30 | | | 30 | | | 30 | | |
| 31 | | | 31 | | | 31 | | | 31 | | |
| 32 | | | 32 | | | 32 | | | 32 | | |
| 33 | | | 33 | | | 33 | | | 33 | | |
| 34 | | | 34 | | | 34 | | | 34 | | |
| 35 | | | 35 | | | 35 | | | 35 | | |
| 36 | | | 36 | | | 36 | | | 36 | | |
| 37 | | | 37 | | | 37 | | | 37 | | |
| 38 | | | 38 | | | 38 | | | 38 | | |
| 39 | | | 39 | | | 39 | | | 39 | | |
| 40 | | | 40 | | | 40 | | | 40 | | |
| Avg. Voltage | | | Avg. Voltage | | | Avg. Voltage | | | Avg. Voltage | | |

Readings Taken By _____ Remarks/Recommendations _____

*Readings should be taken at installation and annually thereafter.*

# ACCEPTANCE & PERFORMANCE TESTING

Each **battery must be at** 100% State of Charge prior to performing an acceptance or performance test on the battery system. To ensure the batteries are fully charged, the following charge schedule should be followed.

1. Make sure all battery connections are clean, tight (i.e. – torqued to specification) and free of corrosion. Proper battery connections shall be verified via ohmic measurements between the connector and cell post.

2. Batteries should be charged at the equalization rate of 14.40 volts per battery (7.20V for 6V battery) for 24 hours. Temperature compensated charging parameters shall be applied as detailed in "Voltage Compensation Chart" in Appendix B of this manual.

To ensure the batteries are fully charged within 24 hours; the charger used for this equalizing charge must be sized to begin its charge with a charge current equal to at least the minimum, and not to exceed the maximum charge current for the given battery type (model), as called out in Appendix D of this manual. If multiple strings are to be charged simultaneously, the charge current requirement must be multiplied by the number of strings.

**Within 1 hour of the completion of the equalize charge, measure and record each battery's on-charge voltage and temperature measured at the negative terminal.**

**The "Refresh Record Form" in Appendix A can be used to record the requested data.**

If these requirements cannot be met, contact East Penn Reserve Power's Product Support Department for alternate instructions.

Upon completion, the charge voltage should be lowered to the float voltage of 13.50 volts per battery (6.75V for 6V battery) for a minimum period of 72 hours. Reference: IEEE 1188-2005 Section 7.2 for additional requirements.

**NOTE: Batteries shall remain on float charge until the discharge test is performed.**

**Within 1 hour of the start of the discharge test, measure and record each battery's on-charge battery voltage and ohmic value as well as a representative battery temperature measured at the negative terminal. Per IEEE 1188:2005,** a representative minimum of 10% of the battery temperatures are to be averaged to develop the average battery temperature that will be used with the temperature correction factor provided within this document.

The "Refresh Record Form" in Appendix A can be used to record the requested data. NOTE: There shall be no discharges of any duration between the start of the equalization and the completion of the float period. If a discharge does occur, the charging regime detailed above shall be repeated.

Upon completion of the charge, the desired acceptance or performance test can be performed per the following guidelines in conjunction with IEEE-1188.

1. IEEE 1188-2005 states "The discharge rate(s) and test length and their duration(s) should correspond as closely as is practical to the battery duty cycle." Prior to discharging the battery, the desired discharge rate should be within East Penn published ratings, end voltage & temperature. Anything outside of these values shall be reviewed by East Penn Reserve Power's Product Support Department.

2. It is important to ensure all connectors and cables are sized correctly to support the discharge rating. Improper connectors and cable sizing can cause excessive temperature to rise, and excessive voltage drop. This can significantly impact expected runtimes and battery life expectancy. Record individual battery voltages during the discharge. Be sure to record the time at which each battery drops below the design's average end voltage if this occurs during the test.

3. If a DC load bank is used, be sure to disconnect the battery string from the UPS charger/load circuit. If an AC load bank is used, be sure to connect the load bank to the UPS system prior to discharge. Be sure to calibrate the load bank to the desired discharge amp or watt setting while the UPS is operating from its' power supply.

4. During the discharge, if an individual battery is approaching reversal of its polarity (i.e. – 0 volts), but the battery string terminal voltage has not reached its test limit (i.e. – 1.67 vpc), the test should be continued with the bad battery "jumpered out" where feasible. Upon doing this, a new end voltage should be calculated based on the remaining batteries.

5. For discharges 1 hour or greater, capacity should be determined by the time adjustment method defined by IEEE-1188 according to the following formula:

% Capacity 77°F (25°C) = [Ta x Kt x 100] /Ts

Where:
Ta = Actual test time to the specified end voltage
Ts = Rated time to the specified end voltage
Kt = Temperature correction factor (Ref. Table 1)

Discharge tests designed for 1 hour with an average unit temperature of less than 77°F (25°C) **shall follow** the procedure for discharges of less than 1 hour.

For discharges less than 1 hour, capacity should be determined by the rate adjustment method defined by IEEE-1188 according to the following formula.

% Capacity 77°F (25°C) = [Xa x Kc x 100] / Xt

Where:
Xa = Actual rate used during discharge test
Xt = Published rate for actual time of discharge test to specified terminal or cell/unit voltage
Kc = Temperature correction factor (Ref. Table 2)

6. Upon completion of the acceptance or performance test, the battery system should be recharged at the normal float voltage of 13.50 volts per battery (6.75V for 6V battery). Temperature compensation charging parameters shall be applied as detailed in "Voltage Compensation Chart" in Appendix C.

## TABLE 1

**Kt Factor**
**(Discharges ≥ 1 hr.)**

| Temperature | | $K_t$ Factor |
|---|---|---|
| °C | °F | |
| 35.0 | 95 | 0.962 |
| 34.4 | 94 | 0.963 |
| 33.9 | 93 | 0.965 |
| 33.3 | 92 | 0.967 |
| 32.8 | 91 | 0.969 |
| 32.2 | 90 | 0.971 |
| 31.7 | 89 | 0.973 |
| 31.1 | 88 | 0.975 |

| Temperature | | $K_t$ Factor |
|---|---|---|
| °C | °F | |
| 22.2 | 72 | 1.019 |
| 21.7 | 71 | 1.022 |
| 21.1 | 70 | 1.026 |
| 20.6 | 69 | 1.030 |
| 20.0 | 68 | 1.034 |
| 19.4 | 67 | 1.038 |
| 18.9 | 66 | 1.043 |
| 18.3 | 65 | 1.047 |

## TABLE 2

**Kc Factor**
**(Discharges ≤ 1 hr.)**

| Temperature | | $K_t$ Factor |
|---|---|---|
| °C | °F | |
| 35.0 | 95 | 0.962 |
| 34.4 | 94 | 0.963 |
| 33.9 | 93 | 0.965 |
| 33.3 | 92 | 0.967 |
| 32.8 | 91 | 0.969 |
| 32.2 | 90 | 0.971 |
| 31.7 | 89 | 0.973 |
| 31.1 | 88 | 0.975 |
| 30.6 | 87 | 0.954 |
| 30.0 | 86 | 0.958 |

| Temperature | | $K_t$ Factor |
|---|---|---|
| °C | °F | |
| 22.2 | 72 | 1.019 |
| 21.7 | 71 | 1.022 |
| 21.1 | 70 | 1.026 |
| 20.6 | 69 | 1.030 |
| 20.0 | 68 | 1.034 |
| 19.4 | 67 | 1.038 |
| 18.9 | 66 | 1.043 |
| 18.3 | 65 | 1.047 |
| 17.8 | 64 | 1.109 |
| 17.2 | 63 | 1,119 |

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