

# Deka® unigy II

## AVR45 SERIES—RAILWAY APPLICATION INSTALLATION AND OPERATION MANUAL



**California  
Proposition 65  
Warning:**

Batteries, battery posts, terminals and related accessories contain lead and lead compounds, and other chemicals known to the state of California to cause cancer and birth defects or other reproductive harm. **Wash hands after handling.**

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**DANGER** Lead Acid Battery Contains: Lead, Sulfuric Acid (Electrolyte), Lead Compounds.

Harmful if swallowed, inhaled, or in contact with skin.  
 Acid causes severe skin burns and eye damage.  
 May damage fertility or the unborn child if ingested or inhaled.  
 May cause harm to breast-fed children.  
 May cause cancer if ingested or inhaled.  
 Causes skin irritation, serious eye damage.  
 Contact with internal components may cause irritation or severe burns.  
 Causes damage to central nervous system, blood and kidneys through prolonged or repeated exposure if ingested or inhaled.  
 Irritating to eyes, respiratory system, and skin.  
 May form explosive air/gas mixture during charging.  
 Extremely flammable gas (hydrogen). Explosive, fire, blast or projection hazard.  
 Obtain special instructions before use.  
 Do not handle until all safety precautions have been read and understood.  
 Wash thoroughly after handling.  
 Do not eat drink or smoke when using this product.  
 Avoid contact during pregnancy/while nursing.

Wear protective gloves/protective clothing, eye protection/face protection.  
 Use only outdoors or in a well-ventilated area.  
 Avoid contact with internal acid.  
 Do not breathe dust/fume/gas/mist/vapors/spray.  
 Keep away from heat/sparks/open flames/hot surfaces. No smoking.  
 IF SWALLOWED OR CONSUMED: rinse mouth. Do NOT induce vomiting.  
 Call a poison center/doctor if you feel unwell.  
 IF ON CLOTHING OR SKIN (or hair): Remove/Take off immediately all contaminated clothing and wash it before reuse. Rinse skin with water/shower.  
 IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER or doctor/physician.  
 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.  
 If exposed/concerned, or if you feel unwell seek medical attention/advice.  
 Store locked up, in a well-ventilated area, in accordance with local and national regulation.  
 Dispose of contents/container in accordance with local and national regulation.  
 Keep out of reach of children.

**PROPOSITION 65 WARNING:** battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. Batteries also contain other chemicals known to the State of California to cause cancer. **WASH HANDS AFTER HANDLING.**

**WARNING:** Risk of fire, explosion or burns. Do not disassemble or incinerate. Not recommended for inverted use. Follow product charging instructions. **High Voltage:** Risk of shock. Do not touch uninsulated terminals or connectors.

**Do Not Remove Vent Valve**

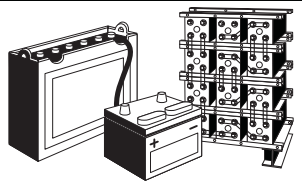
**Manufactured by: East Penn Manufacturing Co.**  
**102 Deka Road, Lyon Station, PA 19536 USA 610-682-6361**    **Lead Acid Battery Electrolyte (Sulfuric Acid)**

**30**

**UL Recognized Component MH17218**

**Pb**

**BATTERIES AND OTHER RELATED PARTS CONTAIN LEAD**



**WARNING:**  
 Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm.  
 Batteries also contain other chemicals known to the State of California to cause cancer.  
**WASH HANDS AFTER HANDLING!**

Form No. 1214 Rev. 8/08 Must be posted in workplace near batteries.

Fig. 1-1

## IN REFERENCE TO THIS MANUAL:

- “Cell” is defined as an individual 2-volt unit.
- “Battery string” is defined as a series connected electrical system comprised of cells (individual 2-volt units).

## SAFETY PRECAUTIONS

Although all valve-regulated cells have the electrolyte immobilized within the cell, the electrical hazard associated with batteries still exists. **Work performed on these batteries should be done with the tools and the protective equipment listed below.** Valve-Regulated cell 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 cells 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 cells and protection of personnel shall be available:

1. **Safety glasses with side shields, or goggles, or face shields as appropriate. (Consult application specific requirements)**
2. Electrically insulated gloves, appropriate for the installation.
3. Protective aprons and safety shoes.
4. Portable or stationary water facilities in the battery vicinity for rinsing eyes and skin in case of contact with acid electrolyte.
5. Class C fire extinguisher.
6. Acid neutralizing agent.
7. Adequately insulated tools (as defined by ASTM F1505 "Standard Specification for Insulated and Insulating Hand Tools")
8. Lifting devices of adequate capacity, when required.

### Procedures

The following safety procedures should be followed during installation:

(Always wear safety glasses or face shield when working on or near batteries.)

1. These cells are sealed and contain no free electrolyte. Under normal operating conditions, they do not present any acid danger. However, if the cell 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. SDS sheets can be obtained at [www.eastpenmanufacturing.com](http://www.eastpenmanufacturing.com)**
2. **Prohibit smoking and open flames, and avoid arcing in the immediate vicinity of the battery.**
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 local codes**) and follow recommended charging voltages.
6. **Never** remove or tamper with the pressure relief valves. Warranty void if vent valve is removed.
7. Inspect all flooring and lifting equipment for functional adequacy.
8. Adequately secure battery modules, racks, or cabinets to the floor.
9. Connect support structures to ground system in accordance with applicable codes.

### Procedures *continued*

10. The IEEE Standards contain additional information. Other standards may be relevant to your specific application.
  - IEEE 1184 – Guide for Batteries for UPS Systems
  - IEEE1187 – Recommended Practice for Installation Design of VRLA Batteries.
  - IEEE 1188 – Recommended Practice for Maintenance, Testing, of VRLA Batteries.
  - IEEE 1189 – Selection of VRLA Batteries for Stationary Applications

## RECEIVING & STORAGE

### Receiving Inspection

Upon receipt, and at the time of actual unloading, each package should be visually inspected for any possible damage or elec-trolyte leakage. If either is evident, a more detailed inspection of the entire shipment should be conducted and noted on the bill of lading. Record receipt date, inspection data, and notify the carrier of any damage.

### Unpacking

1. **Always wear eye protection.**
2. Check all batteries for visible defects such as cracked containers, loose terminal posts, or other unrepairable problems. Batteries with these defects must be replaced.
3. Check the contents of the package 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 the batteries by the terminal posts.
5. When lifting batteries, the proper equipment is needed such as a forklift or a portable crane. Always check the lifting capacities of the equipment being used and never lift more than one cell at a time by the handles in the metal sleeve.

### Storage

1. Cells should be stored indoors in a clean, level, dry, cool location. Recommended storage temperature is 0°F to 90°F (-18°C to 32°C).
2. Stored lead cells self discharge and must be given a boost charge to prevent permanent performance degradation.
  - 0°F to 77°F (-18°C to 25°C) storage:**  
Batteries should be recharged six months from date of manufacture.
  - >77°F (25°C) storage:**  
Use the chart below for recharge intervals. Voltage readings should be taken on a monthly basis. Cells that reach 2.10V per cell or less should be recharged regardless of scheduled interval. Record dates and conditions for all charges during storage.
3. If a boost charge is required; the recommended charge is 24 hours at a constant voltage equal to 2.40V per cell.
4. Do not store beyond 12 months.

## 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 grated 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.

## Grounding

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

**Note:** Battery system grounding and/or individual module grounding, if required, is the installer's responsibility.

## Racks

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

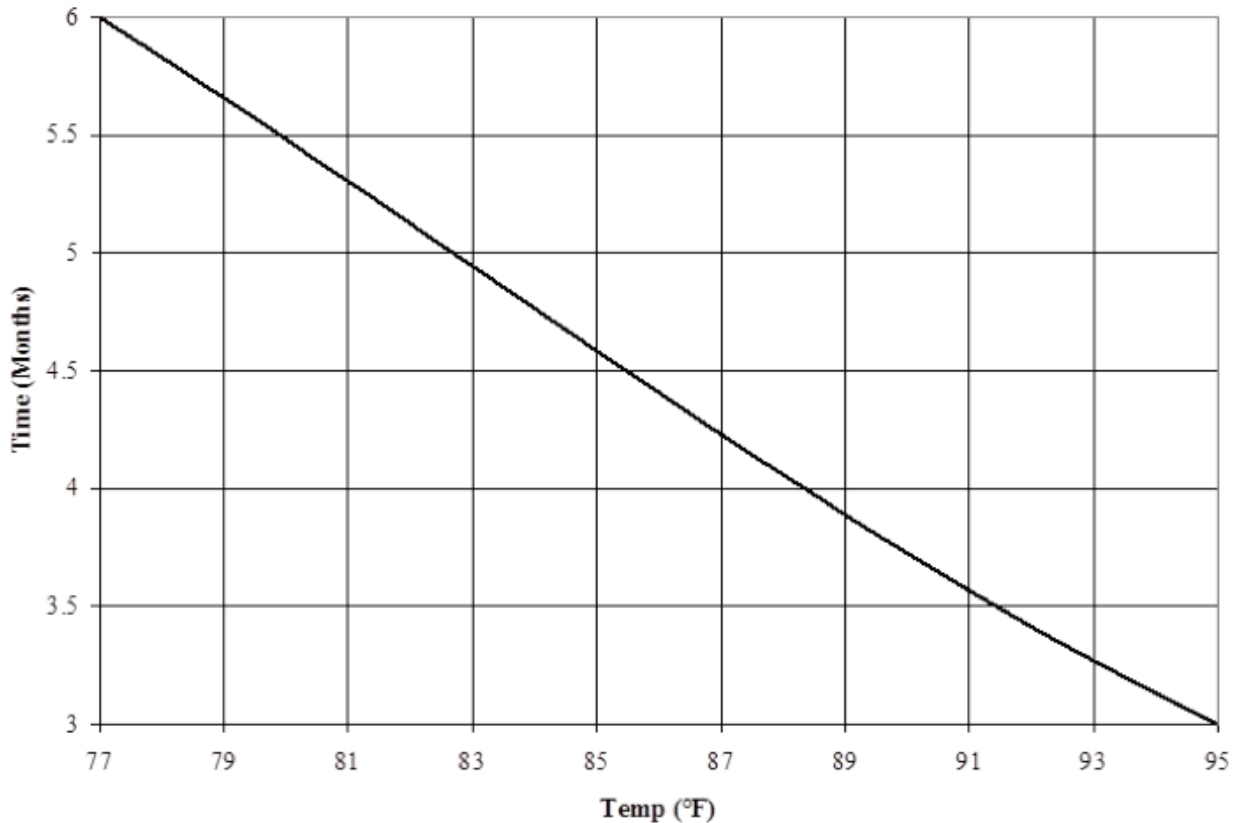
## Electric Code for Maintenance Access

Refer to ANSI/NFPA-70 National Electric Code for access and working space requirements around the battery. A minimum of 36" aisle space is required in front of the battery system for service and inspection.

## Hardware Torque/Retorque Requirements

Bolt Size	Torque / Re-torque
1/4-20	125 in lb 14.1 Nm

Recharge Interval Chart



# SYSTEM INSTALLATION

## Cell Installation

Assemble system per the following details.

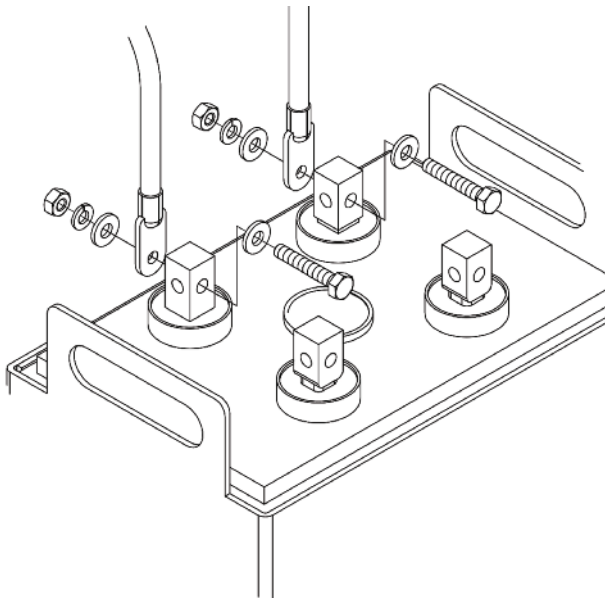
**CAUTION: Never lift more than one cell at a time.**

1. Ensure sufficient space has been allowed for proper and safe battery installation and maintenance.
2. If cells are to be installed on a rack or cabinet, follow rack/cabinet manufactures instructions for correct installation.
3. Batteries may be installed with posts in a vertical or horizontal position. When installing in horizontal or vertical position, ensure battery post are provided with ample clearance from metal parts of rack/cabinet.

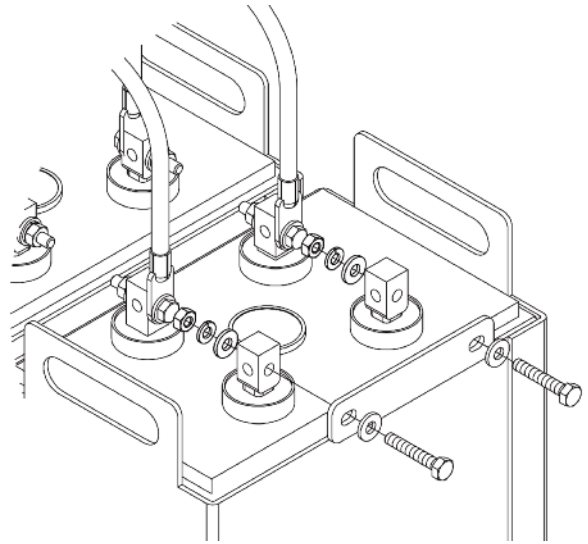
## ELECTRICAL CONNECTION

### Connector / Cable Assembly

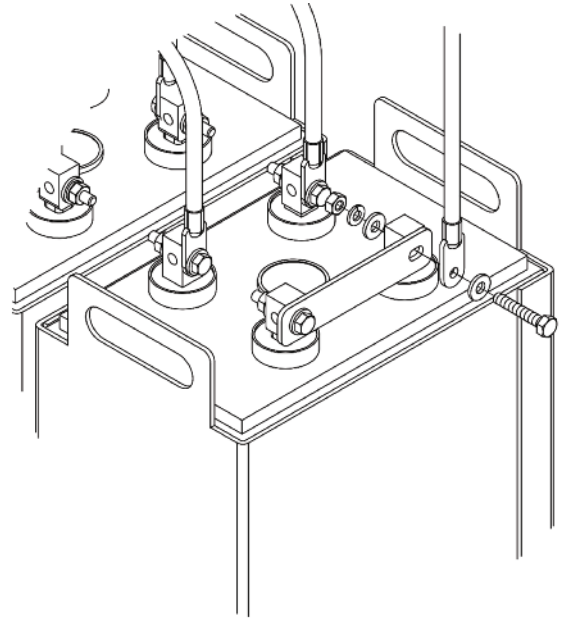
1. The contact surfaces of each individual post on every cell has been cleaned and coated with a thin film of NO-OX-ID "A" grease at the factory. Ensure the contact surfaces are free of dust or dirt prior to assembly. Re-application of NO-OX-ID "A" grease may be required if post cleaning is required.
2. Connectors/cable lugs supplied with cells. It is recommended all connectors/cables be coated with a thin film of NO-OX-ID "A" grease.
3. Install the cables loosely to allow for final alignment. Spacing between cells should be a minimum of 0.50" (12.7mm) for even airflow around cells.



4. For multipost batteries (17 to 33 plate) a connector is to be installed at the battery system positive and negative end of each multiple cell configuration. This connector is used to electrically tie all same polarity posts together.



5. Charging / load cable(s) should be tin or lead plated copper lugs able to accept a 1/4 -20 bolt. Cable lugs should be coated with a thin film of NO-OX-ID "A" grease. System connecting cables can be attached to any battery post of the multipost connector. System connecting cable(s) supplied by others. **Select cable size based on current carrying capability and voltage drop.**



6. Reference Appendix C for layout drawings detailing cable and connector quantity and placement.
7. Upon completion of installing, all connectors / cables hardware should be torqued to 125 ± 5 inch pounds (14.1 ± .5 Nm).

## Final Assembly Check Procedure

1. For future identification of all cells, number individual cells in sequence, beginning with number one (1) at the positive end of the battery. The last cell of the battery string is located at the negative output terminal.
2. Read and record the voltages of the cells to assure that they are connected properly. The total battery string voltage should be approximately equal to the number of cells connected in series multiplied by the measured voltage of one cell. If the measurement is less, recheck the connections for proper polarity. Verify that all cell and battery string connections have been properly torqued.
3. Measure and record the intercell connection resistance using a micro-ohms meter. This helps determine the adequacy of initial connection installation and can be used as a reference for future maintenance requirements. Refer to the recording forms in Battery Maintenance Report of this manual. Review the records of each connection and detail resistance measurements. Clean, remake, and re-measure any connection that has a resistance measurement greater than 10% of the average of all the same type connections (i.e. intercell, intermodule, etc.).
4. Battery string performance is based on the output at the battery terminals. Therefore, the shortest electrical connection between the battery system and the operating equipment results in maximum total system performance.

### Select cable size based on current carrying capability and voltage drop.

Cable size should not provide a greater voltage drop between the battery string and operating equipment than required. Excessive voltage drop in cables will reduce the desired reserve time and power from the battery string.

**Cable sizing is the responsibility of site electrical engineer.**

## SYSTEM OPERATIONS

### Charger Voltage

**2.25 V per battery  $\pm$  0.01 @ 77°F (25°C)**

When setting the float voltage on the charger, the battery string should be set to float at the required cell float voltage times the number of cells per battery string. The charger must be able to maintain the battery string voltage within  $\pm$  0.5% of the desired level at all times.

### Charge Current

Charge current should not exceed the recommended minimum and maximum requirements as detailed in Appendix B.

### Temperature Compensation

Battery voltage should be adjusted for ambient temperature variations.

**2mV per °C (1.8°F) per 2V cell.**

Consult **Voltage Compensation Chart (Appendix B)** for temperature compensation voltage maximum and minimum limits.

### Cell Voltage

Although the charger must maintain the battery string voltage within  $\pm$  0.5%, individual cell voltages may vary by  $\pm$  0.05 volts of the average cell float voltage.

### Equalizing

Upon installation of the battery string, an optional charge at a constant voltage equal to 2.40V per cell  $\pm$  0.01 @ 77°F (25°C) for a maximum of 24hrs may be performed. (NOTE: Verify that the higher cell voltage will not adversely affect any other connected equipment). If this is done, be sure to reset the charging equipment to the proper float voltage.

### Battery Operation

Battery string operating temperature will affect 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%

It is not recommended to operate the battery string above 95°F (35°C). If operating temperatures are expected to be in excess of 95°F (35°C), contact East Penn for recommendations. Operating a battery string over 105°F (40.5°C) for more than 8 hours may void warranty.

Discharging at temperatures less than 77°F (25°C) will reduce the capacity of the battery and require longer charging time to become fully charged. **If operating temperatures are expected to be less than 50°F (10°C) contact East Penn for trecommendations.**

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 temperature.

## **Rectifier Ripple Voltage**

### **FREQUENCY**

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

Ripple that has a frequency less than 667Hz (duration greater than 1.5ms), must meet the following voltage specification to be acceptable.

### **VOLTAGE**

Ripple voltage shall be less than 0.5% peak to peak (0.177% rms) of the manufacturer's recommended battery string voltage.

**Failure to comply can void the warranty.**

## **RECORD KEEPING**

### ***Voltages, Temperatures & Ohmic Readings***

Record keeping is an important part of stationary 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.

All measuring equipment should be in good operating condition and accuracy should be confirmed on an annual basis to NIST traceable standards.

**After installation and when the battery string has been on float charge for one week, the data as detailed in the "Maintenance Section" should be recorded. Battery Maintenance Report worksheet provided in Appendix D.**

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

## **MAINTENANCE**

Always wear eye protection when working on or near batteries. Keep sparks and open flames away from batteries at all times. See Safety Precautions on pg. 3.

### ***Annual Inspection***<sup>(1)</sup>

1. Conduct a visual inspection of each cell.
2. Record the battery string voltage.
3. Record the charger voltage.
4. Record the individual cell voltages. The accuracy of the DMM (Digital Multimeter) must be .05% (on dc scale) or better. The DMM must be calibrated to NIST traceable standards. Because float readings are affected by discharges and recharges, these readings must be taken when batteries have been on continuous, uninterrupted float for at least one month. Cells should be within  $\pm 0.05$  volts of the average cell float voltage.
5. Record the ambient temperatures.
6. Record individual cell ohmic readings.
7. Record all intercell, interunit, and terminal connection resistances. Micro-ohm readings should be taken during this inspection. If any reading differs by more than 20% from initial readings taken, retorque the connection. Recheck the micro-ohm reading. If the reading remains high, clean the contact surface according to installation portion of this manual.

<sup>(1)</sup> Other maintenance inspection intervals follow IEEE 1188

## **Battery Cleaning**

1. Disconnect battery system from power source.
2. Dust accumulation can be removed with cloth dampened with clean water.
3. Corrosion buildup should be neutralized using a mixture of baking soda and water or East Penn Mfg supplied battery cleaner (part # 00321).
4. Use cloth dampened with clean water to remove residue.

**Never use solvents to clean the battery.**

## **Capacity Testing**

Do not discharge the batteries beyond the minimum end voltage published by East Penn Mfg. When discharging at higher rates than originally designed, extra connectors may need to be added to prevent excessive voltage drop. When performing capacity testing and recording data use **IEEE 1188** instructions. Should it be determined that any individual battery(ies) or cell(s) need to be replaced, contact your nearest East Penn agent or East Penn Service Center. Minimal information of capacity test data, serial numbers and installation date will be required.

## APPENDIX A

### Unigy II AVR45 Series Battery Weight & Acid Volumes

Battery Type	Cell Weight		Electrolyte (per cell)				Pure Acid (per battery)	
			Volume		Weight		Weight	
	lb	kg	gal	liter	lb	kg	lb	kg
AVR45-5	18	8	0.37	1.40	4.00	1.81	1.60	0.72
AVR45-7	25	11	0.52	1.96	5.60	2.54	2.24	1.02
AVR45-9	32	15	0.67	2.52	7.22	3.28	2.89	1.31
AVR45-11	39	18	0.81	3.08	8.83	4.00	3.53	1.60
AVR45-13	46	21	0.96	3.64	10.43	4.73	4.17	1.89
AVR45-15	53	24	1.11	4.20	12.04	5.46	4.81	2.18
AVR45-17	60	27	1.26	4.76	13.65	6.19	5.46	2.47
AVR45-19	67	30	1.41	5.32	15.26	6.92	6.10	2.77
AVR45-21	74	34	1.55	5.89	16.87	7.65	6.74	3.06
AVR45-23	81	37	1.70	6.45	18.47	8.38	7.39	3.35
AVR45-25	88	40	1.85	7.01	20.08	9.11	8.03	3.64
AVR45-27	95	43	2.00	7.57	21.69	9.84	8.67	3.93
AVR45-29	102	46	2.15	8.13	23.30	10.57	9.31	4.22
AVR45-31	109	49	2.30	8.69	24.91	11.30	9.96	4.52
AVR45-33	116	53	2.44	9.25	26.51	12.03	10.60	4.81

*\*\*Data subject to change without notice. MSDS Sheets can be obtained at [www.dekabatteries.com](http://www.dekabatteries.com)*



## APPENDIX B

### VOLTAGE COMPENSATION CHART

°C	Float Voltage per Battery	°F
≥35	2.230	≥95
34	2.232	93.2
33	2.234	91.4
32	2.236	89.6
31	2.238	87.8
30	2.240	86.0
29	2.242	84.2
28	2.244	82.4
27	2.246	80.6
26	2.248	78.8
<b>25</b>	<b>2.250</b>	<b>77.0</b>
24	2.252	75.2
23	2.254	73.4
22	2.256	71.6
21	2.258	69.8
20	2.260	68.0
19	2.262	66.2
18	2.264	64.4
17	2.266	62.6
16	2.268	60.8
15	2.270	59.0
14	2.272	57.2
13	2.274	55.4
12	2.276	53.6
11	2.278	51.8
≥10	2.280	≥50

12mV per °C

### CHARGE CURRENT LIMITS

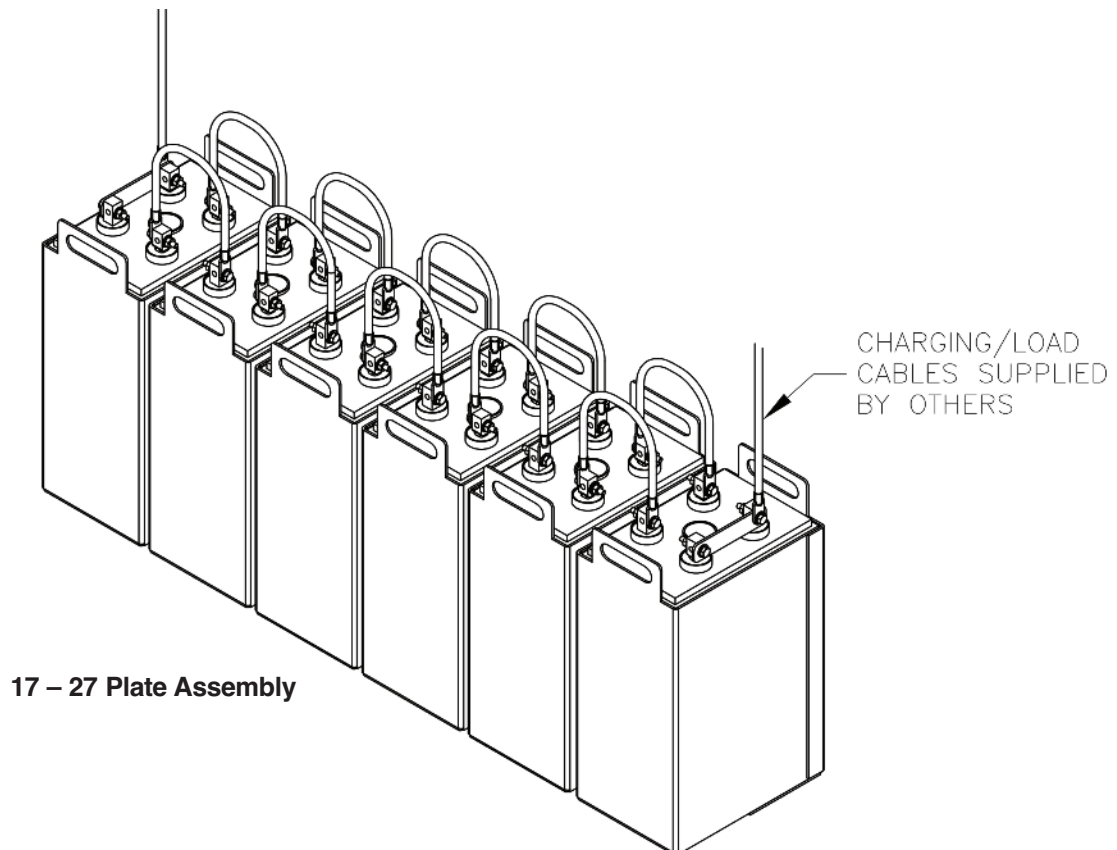
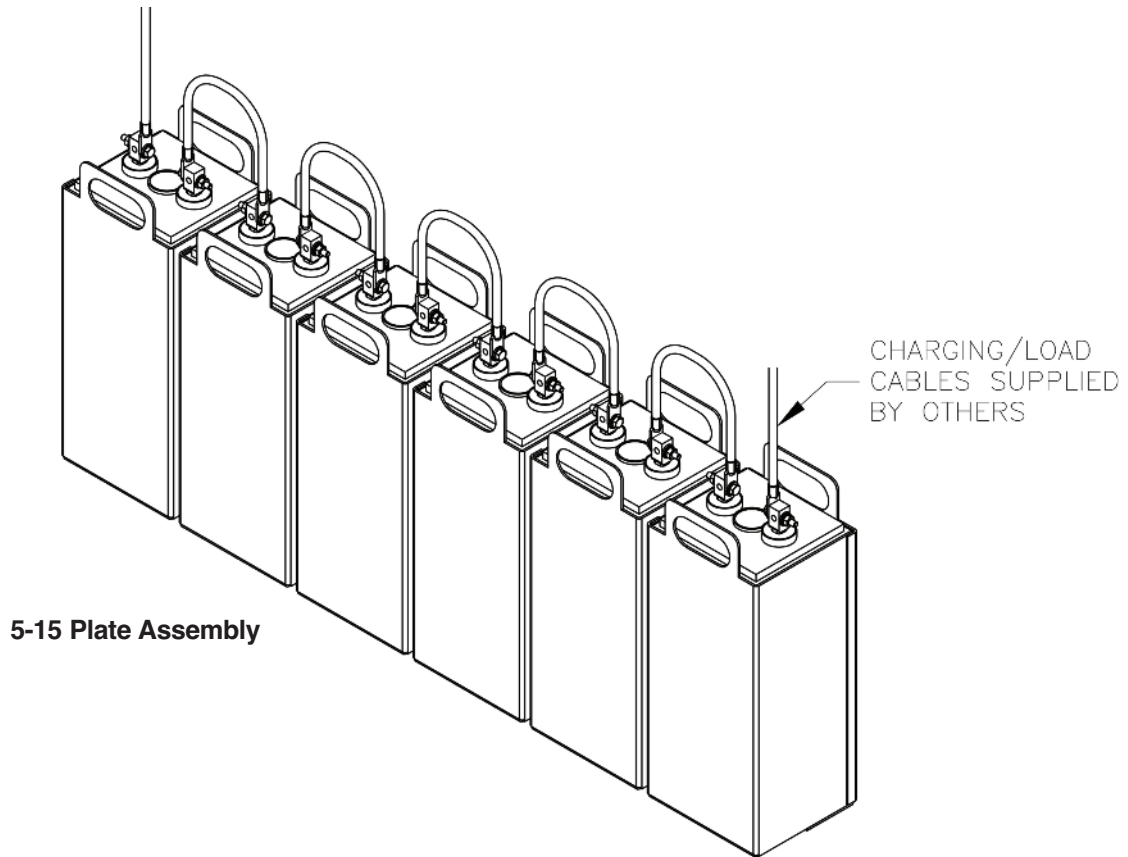
Cell Type	Max. Charge Current (A)	Min. Charge Current (A)**
AVR45-5	16.1	4.8
AVR45-7	24.1	7.2
AVR45-9	32.2	9.6
AVR45-11	40.2	12.1
AVR45-13	48.2	14.5
AVR45-15	56.3	16.9
AVR45-17	64.3	19.3
AVR45-19	72.4	21.7
AVR45-21	80.4	24.1
AVR45-23	88.4	26.5
AVR45-25	96.5	28.9
AVR45-27	105	31.4
AVR45-29	113	33.8
AVR45-31	121	36.2
AVR45-33	129	38.6

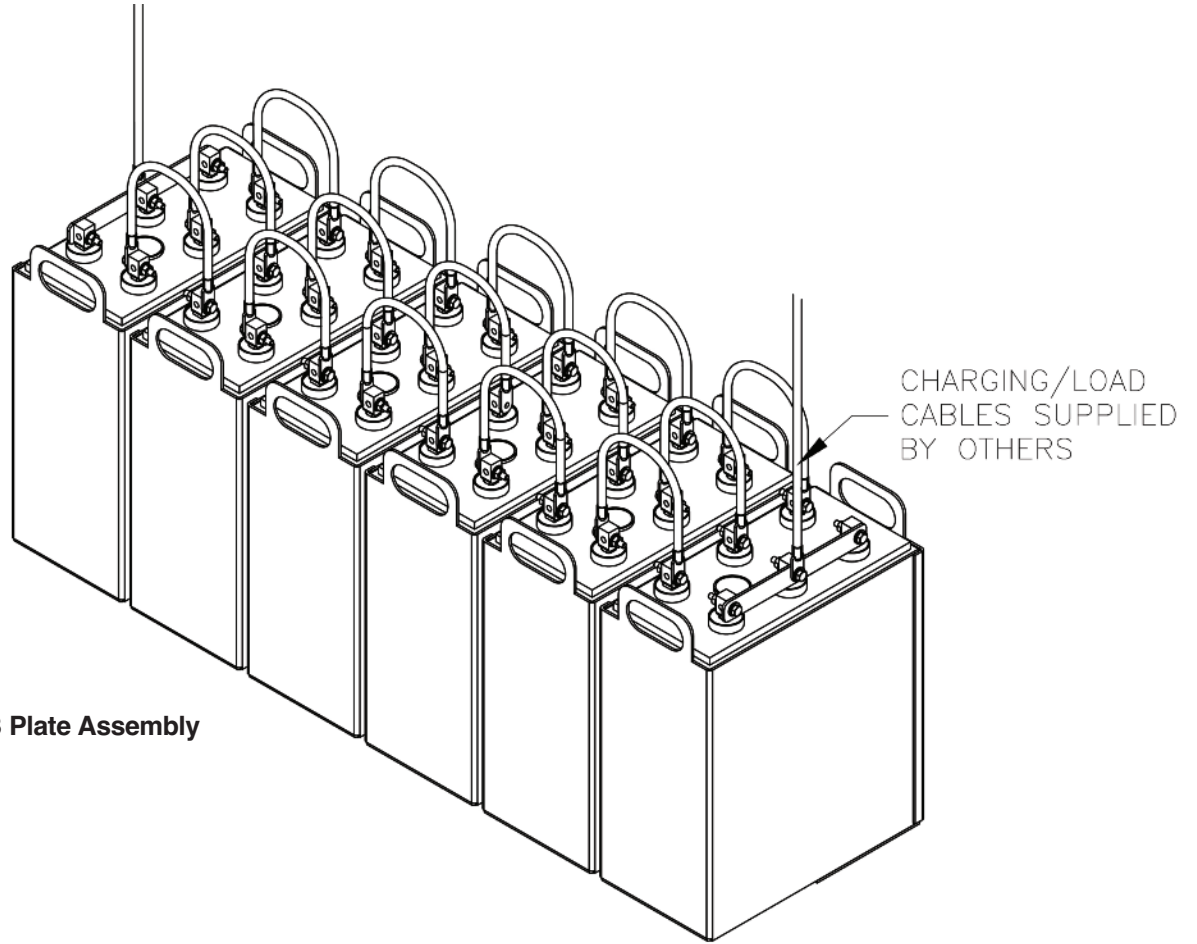
\*\* = Using minimum charge current will extend recharge time and increase risk of battery being undercharged

## APPENDIX C

### System Layout Drawings

Drawing are representation of a 12V (6-cell) system





**29 – 33 Plate Assembly**



**BATTERY MAINTENANCE REPORT**



Company: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 Battery Location & Room #: \_\_\_\_\_  
 Total No. of Cells: \_\_\_\_\_  
 Battery Type 1: \_\_\_\_\_  
 Date of Mfg. 2: \_\_\_\_\_  
 Site Load IN KVA: \_\_\_\_\_  
 UPS Mfg. & Model: \_\_\_\_\_  
 Battery's Environment: \_\_\_\_\_  
 Service Date: \_\_\_\_\_  
 Battery Dwg. #: \_\_\_\_\_  
 Connector Pkg. (See Manual): \_\_\_\_\_  
 Battery I.D. #: \_\_\_\_\_  
 Ambient Air Temperature: \_\_\_\_\_ °F  
 Installer: \_\_\_\_\_  
 Date Installed: \_\_\_\_\_ (Mfg. & Model)  
 Charger Output Voltage: \_\_\_\_\_  
 Total Battery Voltage: \_\_\_\_\_ (To be read @ battery terminals)  
 Panel Meter Voltage: \_\_\_\_\_ (Display Voltage)  
 Conductance / Impedance Meter: \_\_\_\_\_  
 AC Ripple Voltage: \_\_\_\_\_  
 Float Current: \_\_\_\_\_  
 Power Factor of Load: \_\_\_\_\_  
 KVA \_\_\_\_\_  
 Power Factor of Load: \_\_\_\_\_

2 Consult Cell type / Battery Type Label - Found on Retaining Bar or Left Side of Each Module.

Cell / Jar No.	Serial Number	Cell Temp.	Volts (Float)	Cell Ohmic Value 1	Connector Ohmic Value 1	Connector Ohmic Value 2	Connector Ohmic Value 3	Cell / Jar No.	Serial Number	Cell Temp.	Volts (Float)	Cell Ohmic Value *	Connector Ohmic Value 1	Connector Ohmic Value 2	Connector Ohmic Value 3
1								31							
2								32							
3								33							
4								34							
5								35							
6								36							
7								37							
8								38							
9								39							
10								40							
11								41							
12								42							
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25								55							
26								56							
27								57							
28								58							
29								59							
30								60							

1 CONSULT I & O MANUAL, "RECORD KEEPING", FOR ADDITIONAL INFORMATION INCLUDING PROPER LOCATION OF PROBES FOR MULTI-TERMINAL JARS.  
 Remarks and Recommendations: \_\_\_\_\_

Readings Taken By: \_\_\_\_\_  
 (Form available as an Excel Spreadsheet. Consult your EPM Representative.)  
 EPM Form: XXXX 2-3-09  
 Notation: This form must be completed and submitted with any product warranty claim. Readings should be taken at installation and at least annually thereafter.