

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 regulations. 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)

Fig. 1-1

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. 1314 Rev. 5/09 Must be posted in workshop near batteries

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**
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
 - IEEE 1187 – 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 electrolyte 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 unreparable 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 / Refresh

Cells should be installed, and float charged upon delivery. If cells are to be stored, the below requirements shall be followed.

1. Cells shall be stored indoors in a clean, level, dry, cool location.
2. Store, charge, and ship in horizontal position only.
3. 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).
4. The cells shall be given a refresh charge at regular intervals as detailed below:
 - 0°F(-18°C) to 77°F (25°C)**
Cells shall be charged by the "battery charge date" marked on pallet.
Successive recharges shall be performed every 6 months.
 - 78°F (26°C) to 90°F (32°C)**
Cell voltage readings shall be taken monthly. Cells must be given a refresh charge within 3 months from date of receipt or if any cell voltage falls below 2.12 vpc, whichever occurs first.
Successive refresh charges shall be performed every 3 months.
5. 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.
6. Each cell shall be charged for 24 hours at a constant voltage equal to 2.40 volts per cell. To ensure the cells are fully charged within 24hrs, the charger used for this 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 cell type (model), as called out in Appendix C.

Storage / Refresh *continued*

7. All requested information on “Refresh Record Form” in Appendix A should be completed for each refresh charge.
8. Cells shall not be stored beyond 12 months. Storing beyond 12 months will affect warranty.
9. If the storage / refresh requirements cannot be met, contact East Penn Reserve Power Product Support Department for alternate instructions.

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

SYSTEM INSTALLATION

Cell Installation

Assemble system per the following details.

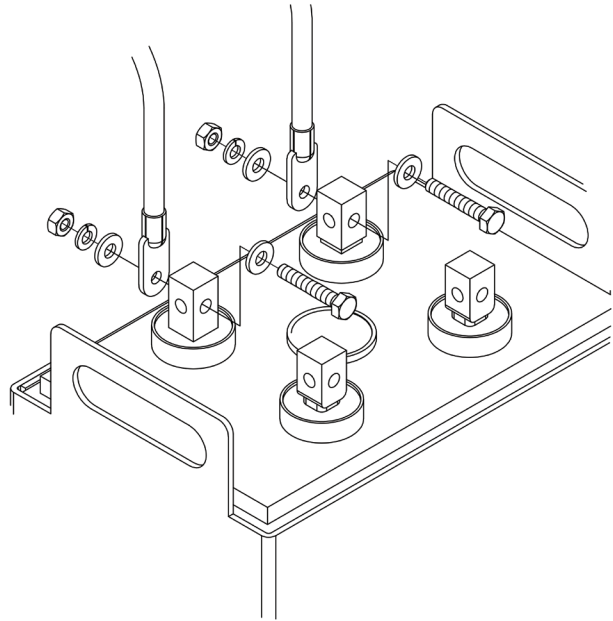
CAUTION: Never lift more than one cell at a time.

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.

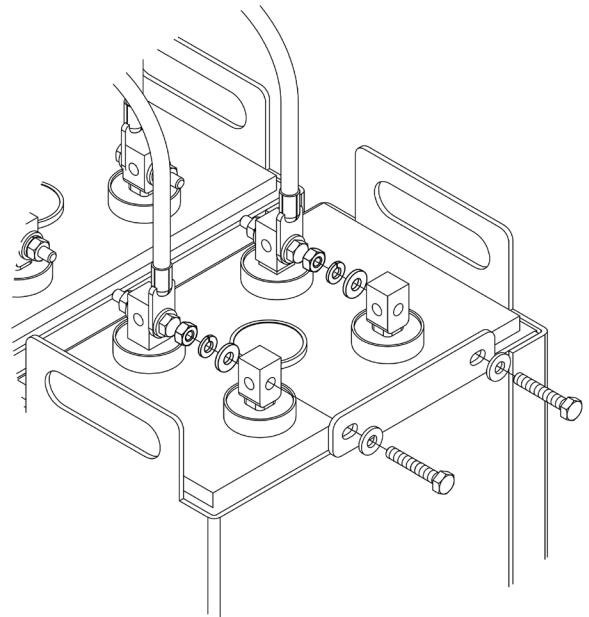
ELECTRICAL CONNECTION

Connector / Cable Assembly

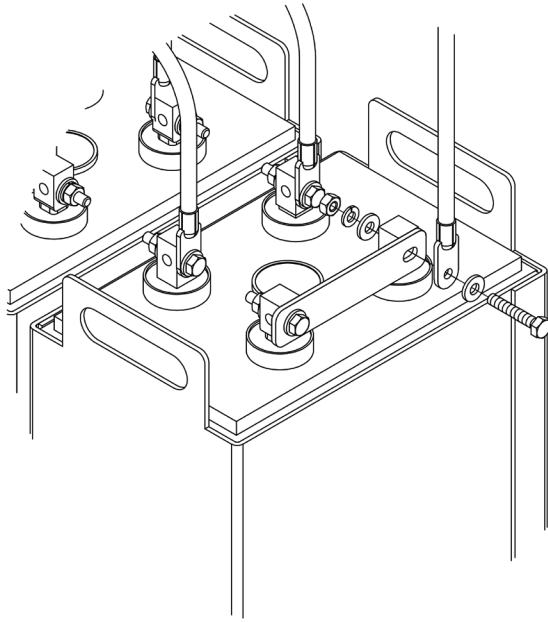
1. The contact surfaces of each individual post on every cell has been cleaned and coated with a thin film of NO-OX-ID “A” grease at the factory. Ensure the contact surfaces are free of dust or dirt prior to assembly. Re-application of NO-OX-ID “A” grease may be required if post cleaning is required.
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 D 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 in Appendix E 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, inter-module, 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 ± 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 ± 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 C.

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 C)** for temperature compensation voltage maximum and minimum limits.

Cell Voltage

Although the charger must maintain the battery string voltage within ± 0.5%, individual cell voltages may vary by ± 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 ± 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.

Battery Operation *continued*

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

Acceptance Testing

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

Cells should be charged at the equalization rate of 2.40 volts per cell for 24 hours. Temperature compensated charging parameters shall be applied as detailed in "Temperature Compensation" in Appendix C of this manual.

To ensure the cells are fully charged within 24hrs; the charger used for this charge must have the current equal to the maximum charge current for the given cell type (model), as called out in Appendix B

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 2.25 volts per cell 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 2.25 volts per cell 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 Product Support Department 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. See Safety Precautions on pg. 3.

Annual Inspection⁽¹⁾

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 ± 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.

⁽¹⁾ 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


Per **IEEE 1188** "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".

When performing capacity testing and recording data refer to IEEE 1188 recommendations.

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

Should it be determined that a battery(ies) need to be replaced contact your nearest East Penn agent or East Penn Service Center.

APPENDIX A

REFRESH RECORD FORM								
	EPM Order Number*		Pallet ID Number		Individual Performing Test (Full Name)		Date of Refresh	Refresh Duration
Model Number	Information Prior to Refresh				Information within 1 hour of Refresh Completion			Notes & Comments
	Date Code	Cell Serial Number	Open Circuit Voltage		Cell Voltage Reading	Charging Current	Cell Temperature	
Cell 1								
Cell 2								
Cell 3								
Cell 4								
Cell 5								
Cell 6								
Cell 7								
Cell 8								
Cell 9								
Cell 10								
Cell 11								
Cell 12								
Cell 13								
Cell 14								
Cell 15								
Cell 16								
Cell 17								
Cell 18								
Cell 19								
Cell 20								
Cell 21								
Cell 22								
Cell 23								
Cell 24								

ALL FIELDS TO THE RIGHT OF THE CELL NUMBER ABOVE MUST BE COMPLETED
 EPM ORDER NUMBER WILL APPEAR ON THE SHIPPING LABEL ON THE CARTON COVERING EACH PALLET OF CELLS
 TO ENSURE CONTINUATION OF WARRANTY, SUBMIT FORMS TO: East Penn Mfg. Co, Inc.,
 Reserve Power Division, Product Support & Warranty Dept. (reservepowerwarranty@dekabatteries.com)

APPENDIX B

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

APPENDIX C

VOLTAGE COMPENSATION CHART

°C	Float	Refresh / Equalize	°F
>35	2.230	2.380	>95
34	2.232	2.382	93.2
33	2.234	2.384	91.4
32	2.236	2.386	89.6
31	2.238	2.388	87.8
30	2.240	2.390	86.0
29	2.242	2.392	84.2
28	2.244	2.394	82.4
27	2.246	2.396	80.6
26	2.248	2.398	78.8
25	2.250	2.400	77.0
24	2.252	2.402	75.2
23	2.254	2.404	73.4
22	2.256	2.406	71.6
21	2.258	2.408	69.8
20	2.260	2.410	68.0
19	2.262	2.412	66.2
18	2.264	2.414	64.4
17	2.266	2.416	62.6
16	2.268	2.418	60.8
15	2.270	2.420	59.0
14	2.272	2.422	57.2
13	2.274	2.424	55.4
12	2.276	2.426	53.6
11	2.278	2.428	51.8
<10	2.280	2.430	<50

12mV per °C

CHARGE CURRENT LIMITS

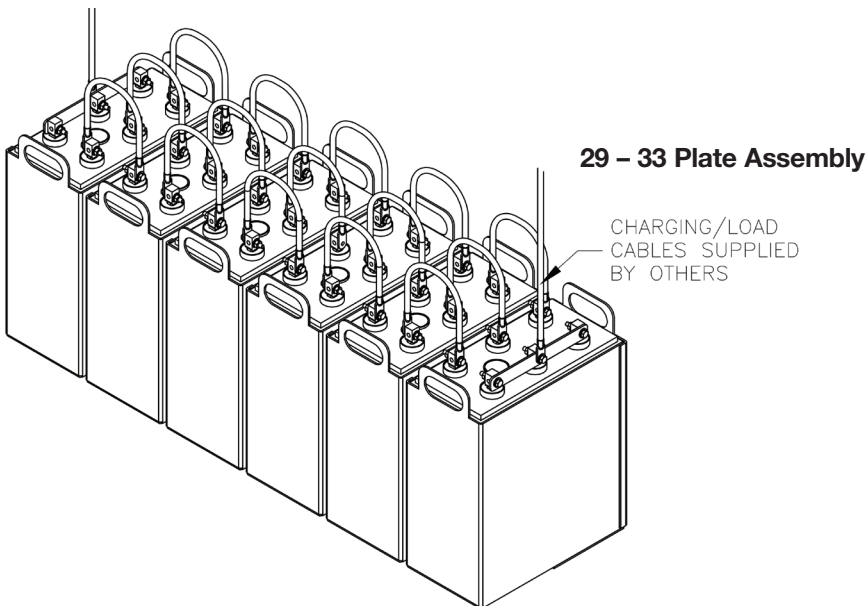
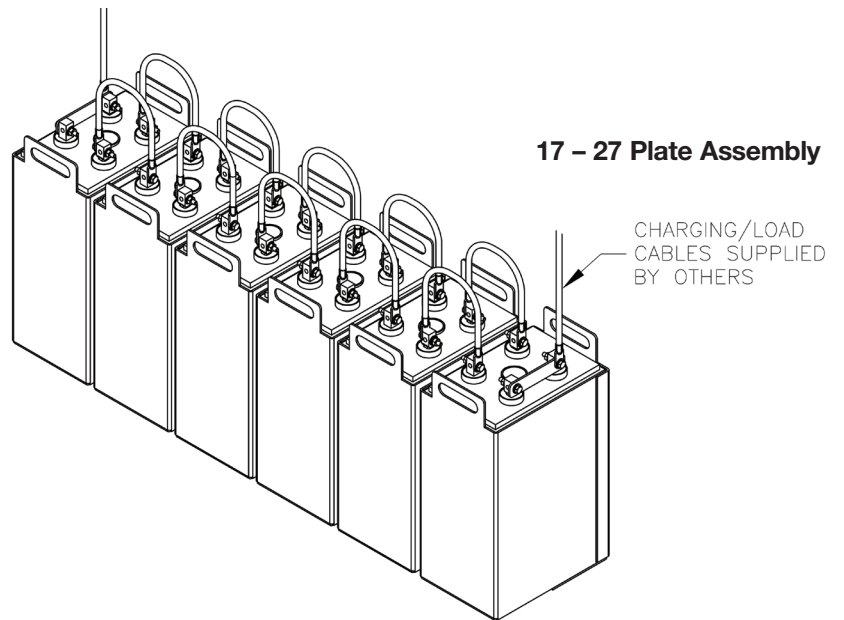
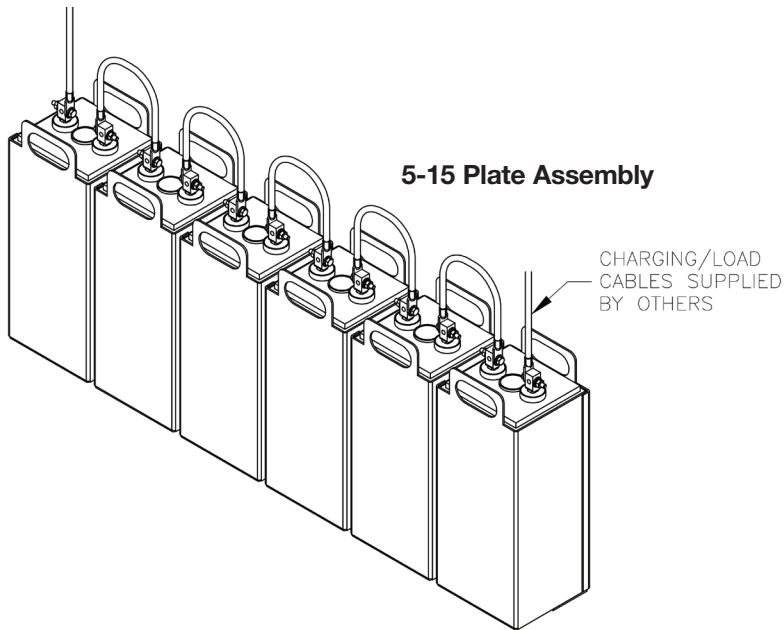
Cell Type	Max. Charge Current (A)	Min. Charge Current (A)**
AVR45-5	16.1	4.8
AVR45-7	24.1	7.2
AVR45-9	32.2	9.6
AVR45-11	40.2	12.1
AVR45-13	48.2	14.5
AVR45-15	56.3	16.9
AVR45-17	64.3	19.3
AVR45-19	72.4	21.7
AVR45-21	80.4	24.1
AVR45-23	88.4	26.5
AVR45-25	96.5	28.9
AVR45-27	105	31.4
AVR45-29	113	33.8
AVR45-31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

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

APPENDIX D

System Layout Drawings

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



BATTERY MAINTENANCE REPORT



Company: _____
 Address: _____
 Battery Location & Room #: _____
 Total No. of Cells: _____
 Battery Type: _____
 Date of Mfg.: _____
 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: _____

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	2	3	Cell / Jar No.	Serial Number	Cell Temp.	Volts (Float)	Cell Ohmic Value ^	1	2	3
1								31							
2								32							
3								33							
4								34							
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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: _____
 EPM Form: XXXX 2-3-09 (Form available as an Excel Spreadsheet. Consult your EPM Representative.)
 Notation: This form must be completed and submitted with any product warranty claim. Readings should be taken at installation and at least annually thereafter.



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