



STATIONARY BATTERY INSTALLATION AND OPERATING INSTRUCTIONS

⚠ DANGER			
HIGH VOLTAGE... RISK OF SHOCK. DO NOT TOUCH UNINSULATED TERMINALS OR CONNECTORS.	SHIELD EYES EXPLOSIVE GASES CAN CAUSE BLINDNESS OR INJURY.	NO SPARKS • FLAMES • SMOKING	SULFURIC ACID CAN CAUSE BLINDNESS OR SEVERE BURNS.
FLUSH EYES IMMEDIATELY WITH WATER.	GET MEDICAL HELP FAST.		
DO NOT REMOVE VENT VALVE. WARRANTY VOID IF VENT VALVE IS REMOVED.		VENTILATE WELL WHEN IN AN ENCLOSED SPACE AND WHEN CHARGING.	
SEE INSTALLATION, MAINTENANCE AND OPERATION INSTRUCTIONS FOR IMPORTANT SAFETY PRECAUTIONS.		REPAIR SHOULD BE PERFORMED ONLY BY A QUALIFIED SERVICE TECHNICIAN.	

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!
<small>Form No. 1218 (Rev. 2008) - Wash hands after handling near battery.</small>

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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SAFETY PRECAUTIONS

Although all valve-regulated batteries 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 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:

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.
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.)

SAFETY PRECAUTIONS (con't)

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 MSDS for additional precautions and first aid measures.**
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 tools and other foreign objects.
5. Provide adequate ventilation (per IEEE standard 1187 and/or local codes) and follow recommended charging voltages.
6. Extinguishing media: Class ABC extinguisher.
Note: CO2 may be used but not directly on the cells due to thermal shock and potential cracking of cases.
7. Never remove or tamper with the pressure relief valves. Warranty void if vent valve is removed.
8. Inspect all flooring and lifting equipment for functional adequacy.
9. Adequately secure battery modules, racks, or cabinets to the floor.
10. Connect support structures to ground system in accordance with applicable codes.
11. The below IEEE Standards contain additional information. Other standards may be relevant to your specific application.

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 AND STORAGE

Receiving Inspection

Upon receipt, and at the time of actual unloading, each pack-age 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 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 packages 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.
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 module and or cell at a time.

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-acid batteries self discharge and must be given a boost charge six months from the date of manufacture to prevent permanent performance degradation. Record dates and conditions for all charges during storage.
3. Recommended charge during storage is at a constant voltage of 0.30 volts per cell greater than recommended float voltage for 24 hours. Reference voltage chart in SYSTEM OPERATION section.
4. Do not store beyond 12 months.
5. Store in horizontal position only

INSTALLATIONS

General

Caution should be taken when installing batteries to insure no damage occurs. The battery cabinet, tray, rack, etc. shall be inspected for sharp edges that could cause damage to the battery casing. Batteries shall not be dropped, slid, 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 system, proper techniques should be applied per electrical standards, such as NEC and/or local codes, as well as User Manual of specific application.

Cabinets

Cabinet systems come factory assembled and prewired. Do not tip or turn cabinets on their sides when positioning them in their intended installation area. Cabinets must be

INSTALLATIONS (con't)

used in an upright position. These systems are preconnected. Only inter-shelf, inter-cabinet and connections to the load are required. See the connection diagram inside the cabinet. 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. See rack assembly instructions.

BATTERY ASSEMBLY

(Always wear eye protection.)

1. Set up the batteries so that the positive post (+) of one battery is connected to the negative post (-) of the next battery for all series connections.
2. The intercell connector contact surfaces shall be cleaned by rubbing gently with a non-metallic brush or pad before installing connectors. No-ox-ID grease can be used but is not required.
3. Install all intercell connectors loosely to allow for final alignment of batteries, then torque. (See Table 1 for correct torque/retorque values.)

General

1. Install the lockwasher and torque the terminal bolts or nuts. (See Table 1 for correct torque values.)
DO NOT OVERTORQUE. Some batteries have cable harnesses (torque value is 45 ± 5).
2. After torquing the connections on racked batteries, read the voltage of the battery string to assure that 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.
3. Read and record intercell 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 A, 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 (intercell, inter-tier or shelf, inter-rack or inter-cabinet).
4. Battery performance is based on the output at the battery terminals. Therefore, the shortest electrical connections between the battery system 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 system and operating equipment than specified. Excess voltage drop will reduce the desired support time of the battery system.

Table 1 — Torque/Retorque Values

Battery Type	Torque/Retorque inch lbs (newton meters)
12AVR30/40	45 ± 5 (5.1 ± .5)
12AVR100ET	60 ± 5 (6.8 ± .5)
All types except: 12AVR30/40 12AVR100ET	100 ± 5 (11.3 ± .5)

SYSTEM OPERATION

Float Service Operation

These batteries are designed for continuous float applications. When setting the float voltage on the charger, the system should be set to float at the nominal battery float voltage times the number of batteries. The charger must be able to maintain the system voltage within $\pm 0.5\%$ of the desired level at all times. The desired float voltage varies with temperature according to the table below.

Battery Temperature		Per Battery Float Voltage $\pm .06$ volts	
		All Unigy types except 12AVR100ET	12AVR100ET
$^{\circ}$ F	$^{\circ}$ C		
50 $^{\circ}$	10 $^{\circ}$	13.50	13.62
59 $^{\circ}$	15 $^{\circ}$		
68 $^{\circ}$	20 $^{\circ}$		
77 $^{\circ}$	25 $^{\circ}$		
86 $^{\circ}$	30 $^{\circ}$		
95 $^{\circ}$	35 $^{\circ}$	13.38	13.50

The average battery operating temperature should not exceed 95 $^{\circ}$ F (35 $^{\circ}$ C) and should never exceed 105 $^{\circ}$ F (40.5 $^{\circ}$ C) for more than an eight-hour period.

Operating at temperatures greater than 77 $^{\circ}$ F (25 $^{\circ}$ C) will reduce the operating life of the battery. If operating temperatures are expected to be in excess of 95 $^{\circ}$ F (35 $^{\circ}$ C), contact East Penn for recommendations.

Battery Voltage

Although the charger must maintain the system voltage within $\pm 0.5\%$, individual battery voltages may vary by ± 0.30 volts of the average battery float voltage.

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 and inform the user if and when corrective action needs to be taken. (Refer to Appendix A, Battery Maintenance Report)

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

After installation and when the batteries have been on float charge for one week, the following data should be recorded:

1. Battery string terminal voltage
2. Charger voltage
3. Individual battery float voltages
4. Individual battery ohmic readings
5. Ambient temperatures
6. Terminal connections should be checked to verify that the installer did torque all connections properly. 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 connections. If the reading still remains high, clean contact surfaces according to Step 2 under Battery Assembly.

MAINTENANCE

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

Annual Inspection⁽¹⁾

1. Conduct a visual inspection of the battery(ies).
2. Record the battery string voltage.
3. Record the charger voltage.
4. Record the individual battery 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 discharge and recharges, these readings must be taken when batteries have been on continuous, uninterrupted float for at least one month. Batteries should be within ± 0.30 volts of the average battery float voltage.
5. Record the ambient temperatures.
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 differs by more than 20% from initial readings taken, re-torque 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.

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 than 1.5ms), must meet the following voltage specification to be acceptable.

VOLTAGE Ripple voltage shall be less than .5% peak to peak (.177% rms) of the manufacturer's recommended string voltage.

Battery Cleaning

Batteries, cabinets, racks, and modules should be cleaned with clean water. If neutralizing is required, use a mixture of baking soda and water. Use clean water to remove baking soda residue. Never use solvents to clean the battery(ies).

Capacity Testing

Do not discharge the batteries beyond the specified final voltage. When discharging at higher rates, 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.

APPENDIX A



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 Unit Number	Volts	Ohms or Mhos	Year Unit Number	Volts	Ohms or Mhos	Year Unit Number	Volts	Ohms or Mhos	Year 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		
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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.

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