



HIGH RATE SERIES

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.
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.	

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!**

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

To assure safe battery handling, installation and maintenance, the following protection equipment should be used:

1. **Safety glasses or face shield**
2. Acid-resistant gloves
3. Protective aprons and safety shoes
4. Proper lifting devices
5. Properly insulated tools

Procedures

The following safety procedures should be followed during installation: **(Always wear safety glasses or face shield.)**

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.**
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.
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. 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 structure to ground system in accordance with applicable codes.

RECEIVING AND 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 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 batteries by the terminal posts.
5. Always lift batteries by the bottom or use the lifting handles.

RECEIVING & STORAGE (Con't)

Storage

1. Cells should be stored indoors in a clean, level, dry and 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 date of manufacture to prevent permanent performance degradation. Record dates and conditions for all charges during storage.
3. Do not store beyond 12 months.

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, 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 system, proper techniques should be applied per electrical standards, such as NEC and/or local codes.

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 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. Make sure they match the connection diagram.
2. The intercell connection contact surfaces should be cleaned by rubbing gently with a non-metallic brush or pad before installing connectors.
3. Install all intercell connections loosely to allow for final alignment of batteries, then torque to 100 ± 5 inch pounds.

General

1. Install the lockwasher and torque the terminal bolts or nuts to 100 ± 5 inch pounds. **DO NOT OVERTORQUE.**

BATTERY ASSEMBLY (Con't)

2. Batteries, cabinets, racks and modules should be cleaned with clear water or a mixture of baking soda and water. Never use solvents to clean the battery.
3. For future identification of all racked batteries, apply individual battery numbers in sequence beginning with number one at the positive end of the first battery.
4. 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.
5. 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 (inter-cell, inter-tier or shelf, inter-rack or inter-cabinet).**
6. Battery performance is based on the output at the battery terminals. Therefore, the shortest electrical connections between the battery system and the operating equipment result in maximum total system performance. **Do not select cable size on current carrying capabilities 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.
7. When paralleling valve-regulated batteries, the capacity, arrangement and external circuit length should be identical for each battery string because a wide variation in battery circuit resistance can result in unbalanced charging (i.e., excessive charging currents in some batteries, and undercharging in others). As a consequence, a single battery failure in one battery string and the subsequent loss of performance capabilities of that string, will result in higher loads in the other parallel string(s), which may exceed the ratings of the battery connections. This can damage the battery system and dramatically shorten battery life.

SYSTEM OPERATION

Charger Voltage

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 ±0.5% of the desired level at all times. The desired float voltage varies with temperature according to the table below.

Battery Temperature		Float Voltage per Battery
°F	°C	
50	10	13.50
59	15	13.50
68	20	13.50
77	25	13.50
86	30	13.50
95	35	13.38

SYSTEM OPERATION *(Con't)*

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.

Equalizing

Upon installation of the battery, an optional boost charge of: **13.80 volts \pm .06 volts** for a maximum of 24 hours can be applied. **(Note: Verify that the higher battery voltage will not adversely affect the other connected equipment.) If this is done, be sure to reset the charging equipment to the proper float voltage.** 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.

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°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 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.

MAINTENANCE *(Con't)*

Annual Inspection ⁽¹⁾ *(Con't)*

3. Record the charge 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, 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.**

Rectifier Ripple Voltage

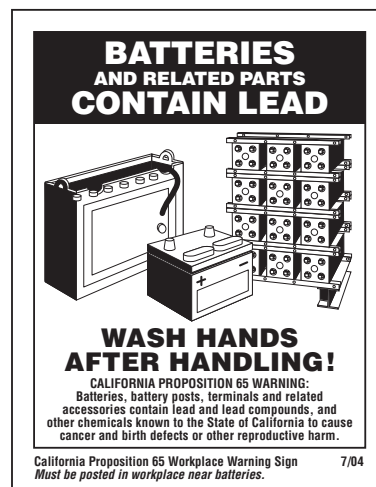
Acceptable charging ripple (peak to peak) shall be less than 0.5% of the manufacturer's recommended string float voltage or have a duration shorter than 8 milliseconds.

Battery Cleaning

Batteries, cabinets, racks and modules should be cleaned with clear water or a mixture of baking soda and water. Never use solvents to clean the battery.

Capacity Testing

Capacity test should not be run unless the battery's operation is questionable. 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 _____

Unit No.	Volts	Ohms or Mhos	Unit No.	Volts	Ohms or Mhos	Unit No.	Volts	Ohms or Mhos	Unit No.	Volts	Ohms or Mhos	Unit No.	Volts	Ohms or Mhos	Unit No.	Volts	Ohms or Mhos
1			41			81			121			161			201		
2			42			82			122			162			202		
3			43			83			123			163			203		
4			44			84			124			164			204		
5			45			85			125			165			205		
6			46			86			126			166			206		
7			47			87			127			167			207		
8			48			88			128			168			208		
9			49			89			129			169			209		
10			50			90			130			170			210		
11			51			91			131			171			211		
12			52			92			132			172			212		
13			53			93			133			173			213		
14			54			94			134			174			214		
15			55			95			135			175			215		
16			56			96			136			176			216		
17			57			97			137			177			217		
18			58			98			138			178			218		
19			59			99			139			179			219		
20			60			100			140			180			220		
21			61			101			141			181			221		
22			62			102			142			182			222		
23			63			103			142			183			223		
24			64			104			144			184			224		
25			65			105			145			185			225		
26			66			106			146			186			226		
27			67			107			147			187			227		
28			68			108			148			188			228		
29			69			109			149			189			229		
30			70			110			150			190			230		
31			71			111			151			191			231		
32			72			112			152			192			232		
33			73			113			153			193			233		
34			74			114			154			194			234		
35			75			115			155			195			235		
36			76			116			156			196			236		
37			77			117			157			197			237		
38			78			118			158			198			238		
39			79			119			159			199			239		
40			80			120			160			200			240		
Avg. Voltage			Avg. Voltage			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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