# NEBS CERTIFIED UNIGY II SYSTEM
# NC4-2000 125 AH

## *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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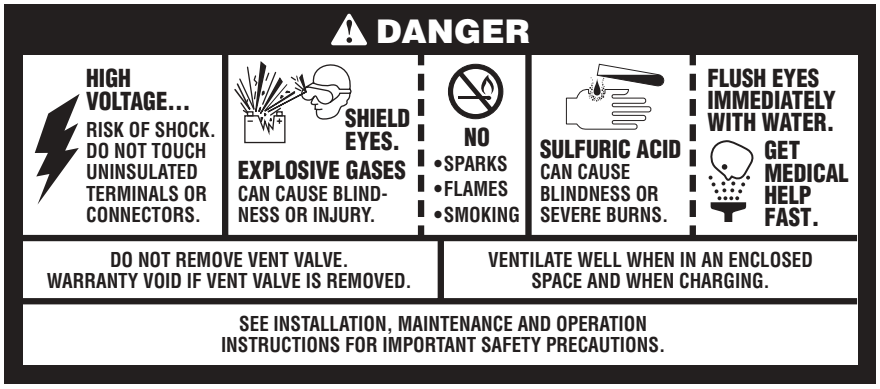


**California Proposition 65 Warning:**

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California Proposition 65 Workplace Warning Sign 7/04
*Must be posted in workplace near batteries.*

# 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.

## *Protective Equipment*

To assure safe battery handling, installation and maintenance, the following protective 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*

**(Always wear safety glasses or face shield when working on or near batteries. Refer to Fig. 1-1, pg. 3)**

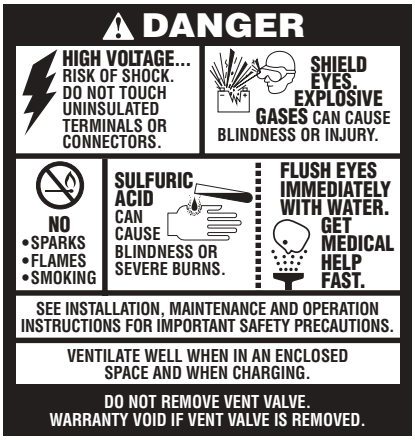
The following safety procedures should be followed during installation:

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 tools and other foreign objects.
5. Provide adequate ventilation **(per IEEE standard 1187 and/or local codes)** and follow recommended charging voltages.
6. Refer to Material Safety Data Sheet for proper extinguishing method. (See Appendix A, Sect. 4, pg. 14.)
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. Specifically review floor-loading capacity.
9. Adequately secure battery modules to the floor.
10. Connect support structures to ground system in accordance with applicable codes.

# RECEIVING & STORAGE

## *Receiving Inspection*

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




| | |
|---|---|
| **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.** |

*Fig. 1-1*

## *Unpacking*

1. Always wear eye protection.
2. Check for visible defects.
3. Check the contents of the package against the packing list. Report any missing parts or shipping damage to your East Penn agent or East Penn Mfg. Co. immediately. (See Fig. 2-1, pg. 8)
4. To remove modules from skid, you must first remove the sleeves / cells, then unbolt the module to module and module from skid. (See Fig. 2-2, pg. 8)
5. Never lift the batteries by the terminal posts. Always lift batteries by the module slots with the lifting straps provided. (See Fig. 2-3, pg. 9)
6. 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 at a time by the module slots.

## *Storage*

1. Cells should be stored indoors in a clean, level, dry, cool location. Recommended storage temperatures are 0˚F to 90˚F (–18˚C to 32˚C). Store in a horizontal position only. Do not store beyond 12 months.
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. **Batteries should not be stored for more than 180 days without applying a boost charge of 2.30 VPC ± .01 volts for a maximum of 24 hours.** Record dates and conditions for all charges during storage.

# INSTALLATION

## *Grounding*

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

Two .201 diameter x .750 center holes are provided in back of each module to accept a #6 x .750 center compression grounding lug. The holes must be tapped for a 1/4-20UNC thread and paint must be removed for a proper grounding pad location.

# INSTALLATION *(con't)*

### *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 recommended in front of the battery for service and inspection.*

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

### *Floor Anchoring & Module Arrangements*

See East Penn Mfg. Co.'s schematic diagram illustration. One is supplied with each shipment. If it cannot be located, contact East Penn Mfg. Co. for a copy. Refer to your delivery number, located on the packing slip. This will aid in obtaining the proper drawing.

### *Module Installations*

Assemble modules per the following details.

**CAUTION: Never lift more than one module at a time with the lifting slings. (See Fig. 3-1, pg. 9.)**

1. Remove the floor-mounting base support from the top of the battery, and bolt base to the floor. **(See local building codes for anchor bolt requirements, anchor bolts not included.)**

   It is important that the base is leveled, prior to stacking modules.
2. With sleeves / cells removed from the module, remove module to module bolts. Use the two slings provided to lift modules.
3. Remove the next module in the same manner as the first. Place in position.
4. As the modules are stacked, bolt together and torque each tier including module to base connection. [Torque 1/2" bolts to 100 ft. lbs. (135.5 Nm)]
5. Replace sleeves / cells using 2 x 4 lumber or equivalent and torque bolts. [Torque 3/8" bolts to 25 ft. lbs. (33.8 Nm).] (See Fig. 8-2, pg. 7)
6. Front shield bracket placement. (See Fig. 4-10, pg. 13)
7. Each battery is shipped with its own schematic. Make sure the polarity on the cells match the drawings.

# ELECTRICAL CONNECTION

### *Connector Assembly*

1. The contact surfaces of each individual post on every cell have been cleaned and coated with a thin film of no-ox-ID "A" grease at the factory. Assure the contact surfaces are free of dust or dirt prior to assembly.
2. The NC4-2000 battery is supplied with connector package "2CU" requiring two connectors per post. Install the connectors loosely to allow for final alignment, then torque to 125 ± 5 inch pounds (14.1 ± .5 Nm.) **The installation and direction of the post bolts is important!** (Refer to Fig. 4-1, pg. 4, Fig. 4-2, pg. 10, Fig. 4-3, pg. 10 and Fig. 4-4, pg. 11)
3. Batteries used in high rate discharge applications require multiple connectors per connection. (Refer to optional connector packages in Fig. 4-5, pg. 4)

*Fig. 4-1*

| Connector Packages |
|---|
| **Standard Package (125 AH)** |
| 2CU: (2) ⅛" connectors / post |
| ≤ 700 amps / 1120 wpc (33 plate) |
| **Optional Packages** |
| 4CU: (4) ⅛" connectors / post |
| ≤ 2000 amps / 3200 wpc (33 plate) |
| 6CU: (6) ⅛" connectors / post |
| ≤ 3000 amps / 4800 wpc (33 plate) |
| **Corresponding Bolt Package** |
| 2CU: ¼-20 x 1½" long — JMP1407 |
| 4CU: ¼-20 x 1¾" long — JMP1435 |
| 6CU: ¼-20 x 2" long — JMP1409 |

*Fig. 4-5*

### *Terminal Assembly*

1. Attach the terminal mounting bracket to the module frame. (See Fig. 4-6, pg. 11 for Side Terminal and Fig. 4-7, pg 12 for Top Terminal)
2. Attach the terminal plates or the terminal connectors to the battery posts and then torque to 125 ± 5 inch-pounds (14.1 ± .5 Nm).
3. For cable connection assembly, (See Fig. 4-8, pg. 12 and Fig 4-9, pg. 13)

### *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 is located at the negative output terminal.
2. Read and record the voltages of the individual cells to assure that they are connected properly. The total battery 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 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 Appendix B of this manual. Review the records of each connection and detail resistance measurements. Clean, remake, and remeasure any connection that has a resistance measurement greater than **10%** of the average of all the same type connections (i.e. intercell, intermodule, etc.).

### *Final Assembly Check Procedure (con't)*

4. Battery 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 system and operating equipment than specified. Excessive voltage drop in cables will reduce the desired reserve time and power from the battery system.

### *Parallel Strings*

When paralleling valve-regulated batteries, the capacity, arrangement, and external circuit length should be identical for each battery. Wide variation in the battery circuit resistance can result in unbalanced charging (i.e., excessive charging currents in some batteries and undercharging in others). As a result, cell failures in one battery string and 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.

### *Module Front Shield Assembly*

1. Place shield on to bracket studs and attach hardware. (See Fig. 4-10, pg. 13)

### *Top Protective Shield Assembly*

For side terminal assembly, attach the top protective cover to the highest front shield.

For top terminal assembly, cut the protective cover to fit between the terminals and then attach to the front shield. Use panel rivet to attach top protective shield to front shield. (See Fig. 4-10, pg. 13)

### *Terminal Plate Shield Assembly*

For side terminal shield assembly, (See Fig. 4-6, pg 11)

For top terminal shield assembly, (See Fig. 4-7, pg. 12)

## SYSTEM OPERATIONS

### *Float Voltages*

When setting the float voltage on the charger, the systems should be set to float at 2.25 ± 0.01 volts per cell times the number of cells per string (@ 77°F (25°C) or less).
For example, a 24 cell system should be set to float at 2.25 vpc x 24 cells = 54 ± 0.24 volts. The charger must be able to maintain the system voltage within ± .5% of the desired level at all times. The desired float voltage varies with the temperature according to the table on the next page

### *Operating Temperatures*

| Temperature Degrees F | Temperature Degrees C | Per Cell Float Voltage ± .01 |
|---|---|---|
| 50˚ | 10˚ | 2.25 |
| 59˚ | 15˚ | 2.25 |
| 68˚ | 20˚ | 2.25 |
| 77˚ | 25˚ | 2.25 |
| 86˚ | 30˚ | 2.25 |
| 95˚ | 35˚ | 2.23 |

### *Equalizing*

Upon installation of the battery, an optional boost charge of 2.30 VPC ± .01 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 back to the proper float voltage.** The average battery operating temperature should not exceed 95˚F (35˚C) and 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 remain 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 B, 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 terminal voltage
2. Charger voltage
3. Individual cell float voltages
4. Individual cell ohmic readings. On a 4-post cell place meter leads on the left positive - left negative posts or right positive - right negative posts. For 6-post cells, measure from center positive - center negative posts. Do not measure diagonally from positive to negative posts. (See Fig. 5-1, pg. 6)
5. Ambient temperatures
6. Terminal connections should be checked to verify that the installer did torque all connections properly (125 ± 5 in.-lbs.). Micro-ohm readings should be taken across every connection. (Refer to Fig. 5-2, pg. 6) 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 125 ± 5 inch-pounds. If the reading still remains high, clean contact surfaces according to Step 2 under Connector Assembly.

*Fig. 5-1*

*Fig. 5-2*

## 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 the battery.
2. Record the battery terminal voltage.
3. Record the charger voltage.
4. Record the individual cell voltages. Cells should be within ± 0.05 volts of the average string cell voltage.
5. Record individual cell ohmic readings.
6. Record the ambient temperatures.
7. Record all interunit and terminal connection resistances.

***[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*

Battery modules and covers should be cleaned with clear water or a mixture of baking soda and water. **Never use solvents to clean the battery.**

### *Capacity Testing*

Capacity tests 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 be sure to check the connector chart. (See Fig. 4-5, pg. 4) 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 cell(s) need to be replaced, contact your nearest Unigy II Agent or East Penn Service Center.

## SLEEVE / CELL REMOVAL PROCEDURE

1. Before removing sleeve / cell, review Safety Precautions on pg. 3 of this manual. Contact East Penn Mfg. Company, Inc. with specific questions or concerns.
2. Refer to Fig. 4-2, pg. 10, Fig. 8-1, pg. 7 and Fig. 8-2, pg. 7 for specific instructions.

## NC4-2000 125 AH Unigy II System Acid Volumes & Weights

| Cell Size | Acid Wt gm | Acid Vol cc | Acid Vol gal | Acid Wt lbs | Pure Acid lbs |
|---|---|---|---|---|---|
| 125-33 | 33,531 | 25,793 | 6.81 | 73.92 | 29.55 |

**** Data subject to change.***

## NC4-2000 125 AH Unigy II System Torque Values

Module to Module - 100 ft/lbs (136 Nm)
Sleeve to Module - 25 ft/lbs (34 Nm)
Cell Retainer to Sleeve - 125 in/lbs (14 Nm)
Connectors - 125 in/lbs (14 Nm)

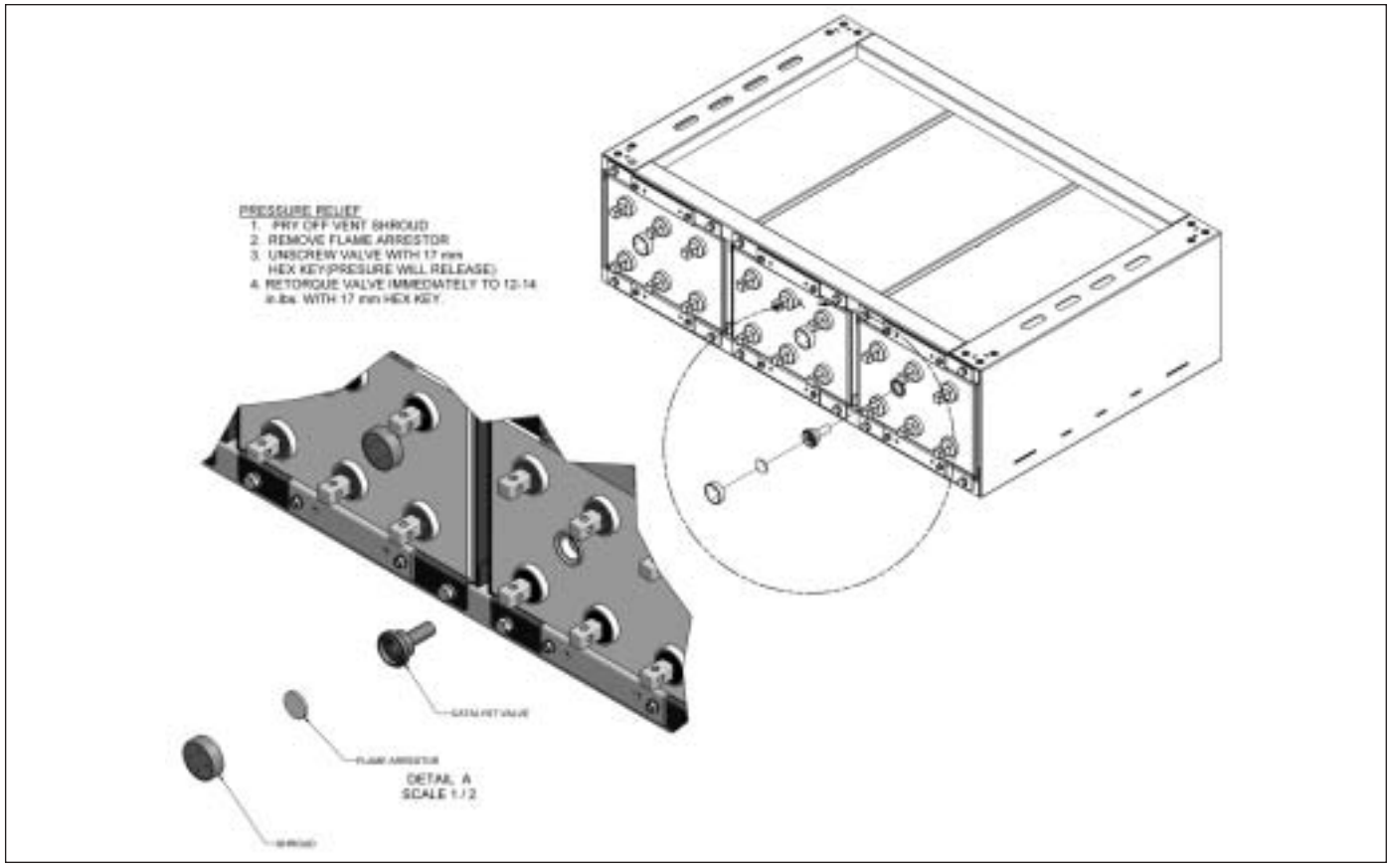

PRESSURE RELIEF
1. PRY OFF VENT SHROUD
2. REMOVE FLAME ARRESTOR
3. UNSCREW VALVE WITH 17 mm HEX KEY(PRESURE WILL RELEASE)
4. RETORQUE VALVE IMMEDIATELY TO 12-14 in.lbs. WITH 17 mm HEX KEY.
DETAIL A
SCALE 1 / 2

*Fig. 8-1*

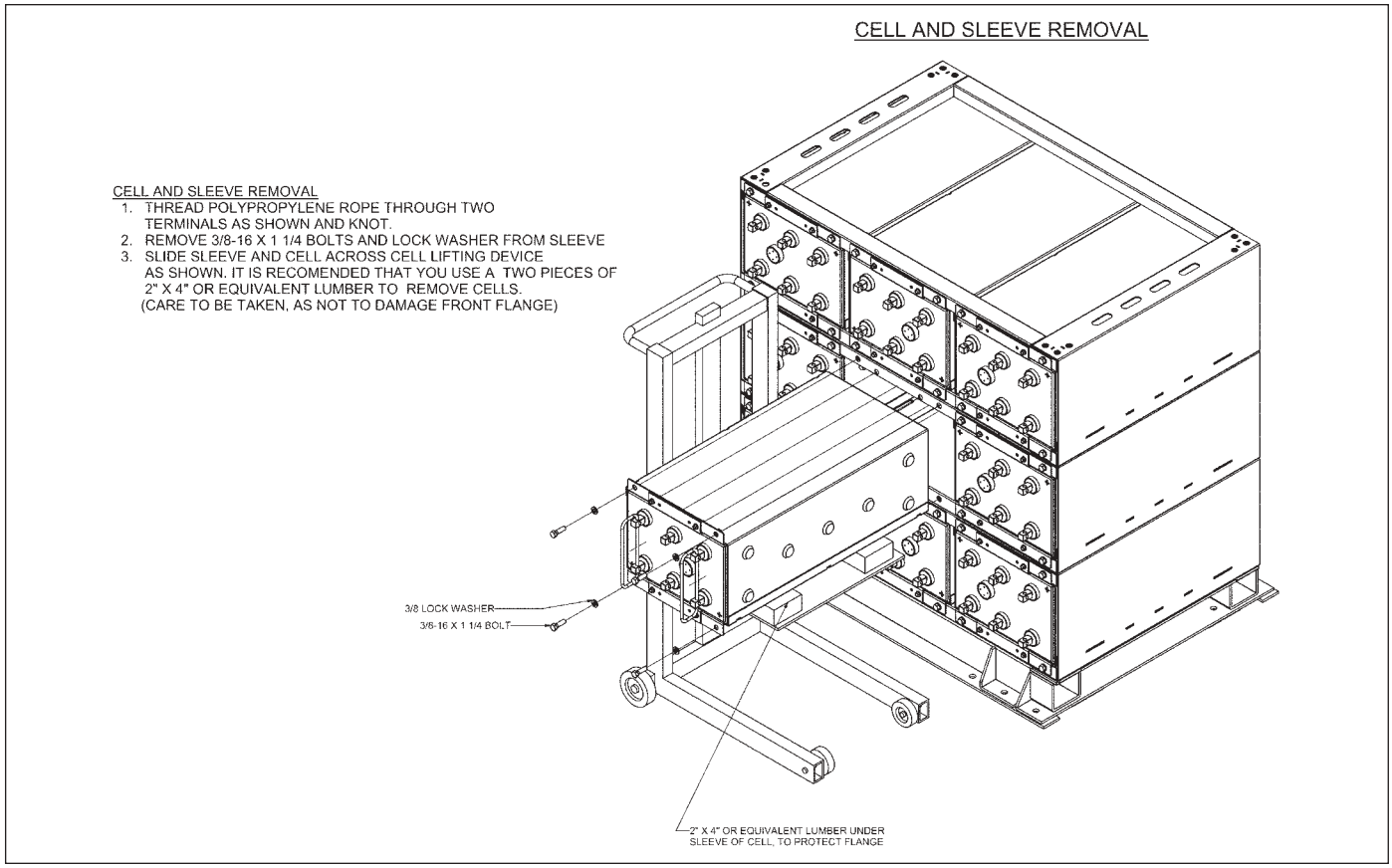

CELL AND SLEEVE REMOVAL
CELL AND SLEEVE REMOVAL
1. THREAD POLYPROPYLENE ROPE THROUGH TWO TERMINALS AS SHOWN AND KNOT.
2. REMOVE 3/8-16 X 1 1/4 BOLTS AND LOCK WASHER FROM SLEEVE
3. SLIDE SLEEVE AND CELL ACROSS CELL LIFTING DEVICE AS SHOWN. IT IS RECOMENDED THAT YOU USE A TWO PIECES OF 2" X 4" OR EQUIVALENT LUMBER TO REMOVE CELLS. (CARE TO BE TAKEN, AS NOT TO DAMAGE FRONT FLANGE)
3/8 LOCK WASHER
3/8-16 X 1 1/4 BOLT
2" X 4" OR EQUIVALENT LUMBER UNDER SLEEVE OF CELL, TO PROTECT FLANGE

*Fig. 8-2*

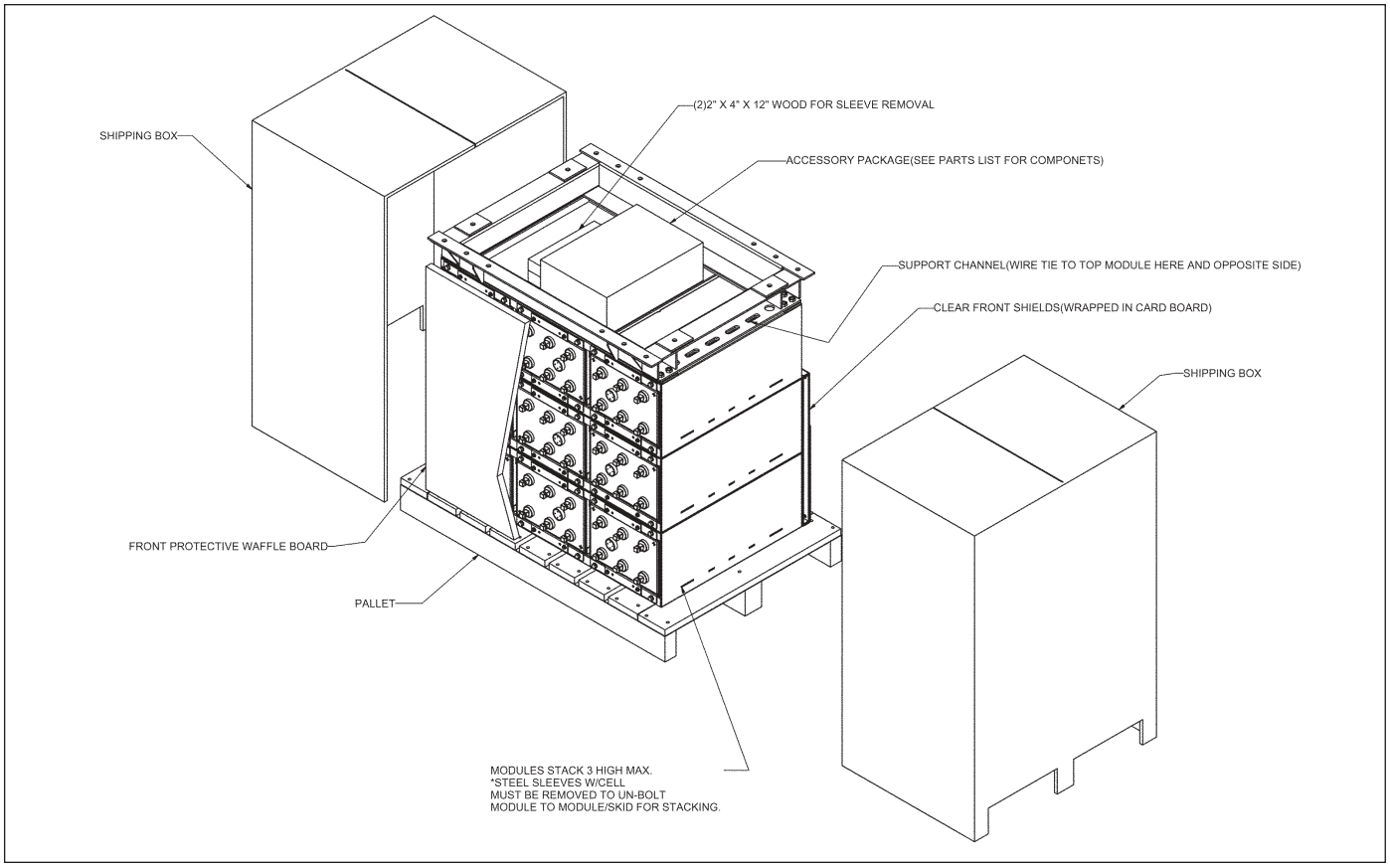
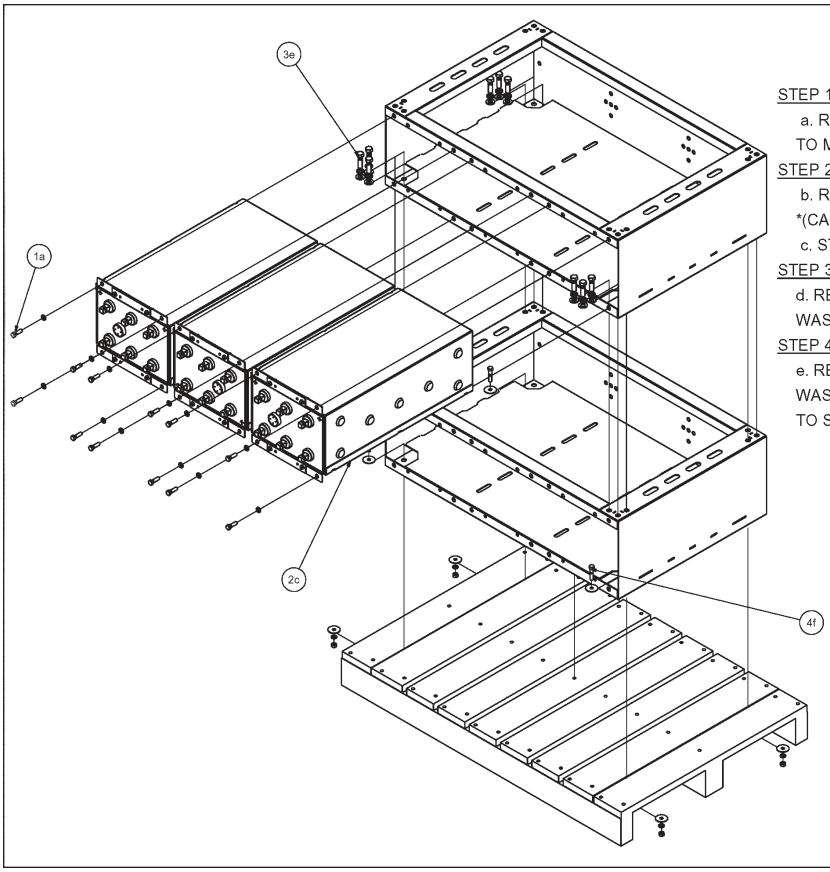



*Fig. 2-1*




STEP 1

a. REMOVE 3/8-16 X 1 1/4 BOLTS & LOCK WASHER FROM SLEEVE TO MODULE

STEP 2

b. REMOVE SLEEVE/CELL AND PLACE ONTO A LIFTING TABLE OR DEVICE *(CARE NEEDS TO BE TAKEN TO PREVENT FRONT FLANGE DAMAGE.)

c. STORE CELLS HORIZONTALLY.

STEP 3

d. REMOVE 1/2-13 X 1 3/4 BOLTS, LOCK WASHER, AND FLAT WASHER FROM MODULE TO MODULE FOR EACH TIER.

STEP 4

e. REMOVE 3/8 X 16 X 1 3/4 BOLTS, FENDER WASHERS, LOCK WASHERS, AND NUTS FROM BOTTOM MODULE TO SKID AND DISCARD.

*Fig. 2-2*

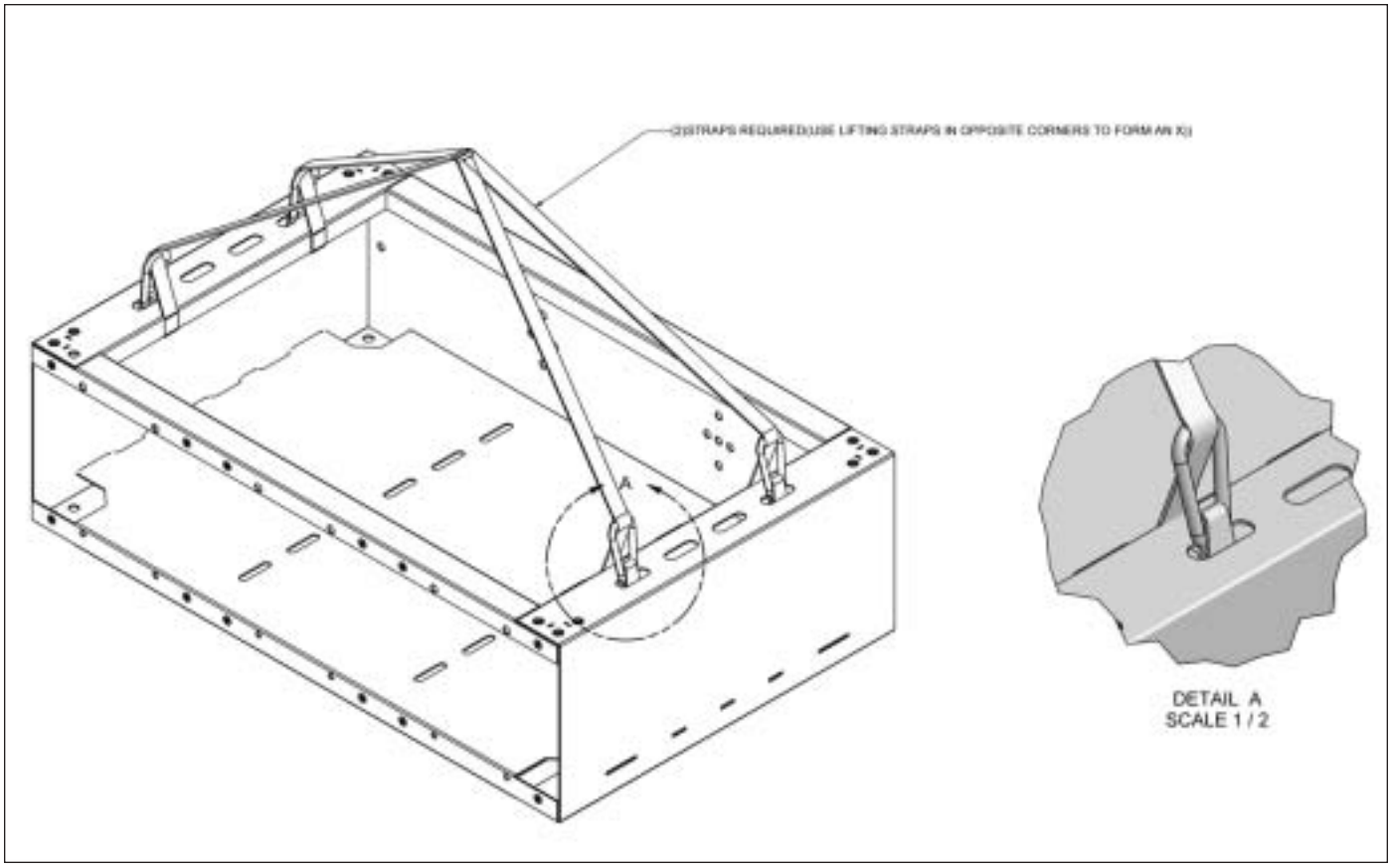

(2)STRAPS REQUIRED,USE LIFTING STRAPS IN OPPOSITE CORNERS TO FORM AN X)
A
DETAIL A
SCALE 1 / 2

*Fig. 2-3*

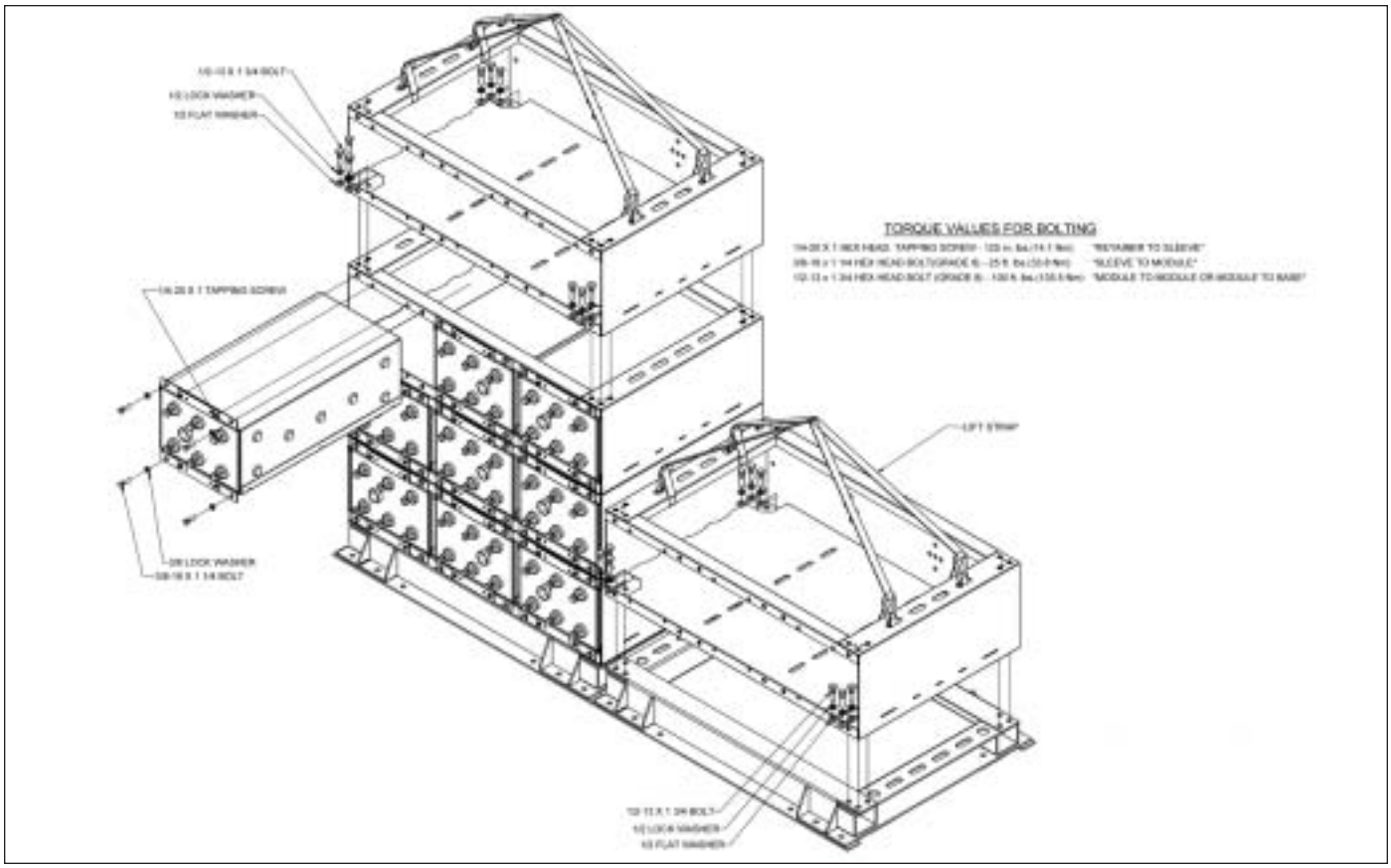

TORQUE VALUES FOR BOLTING

*Fig. 3-1*

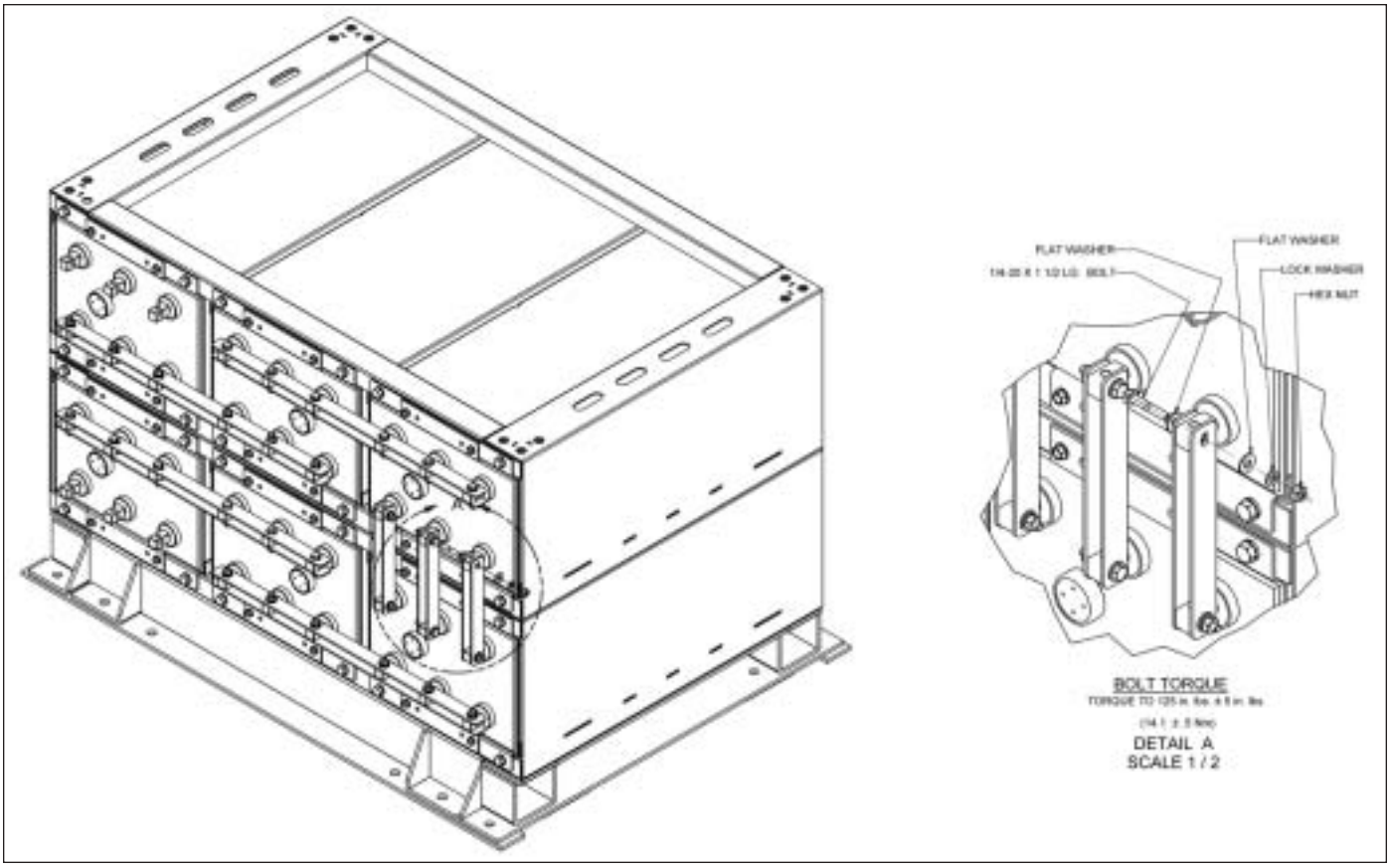

FLAT WASHER
FLAT WASHER
LOCK WASHER
HEX NUT
BOLT TORQUE
DETAIL A
SCALE 1 / 2

*Fig. 4-2*

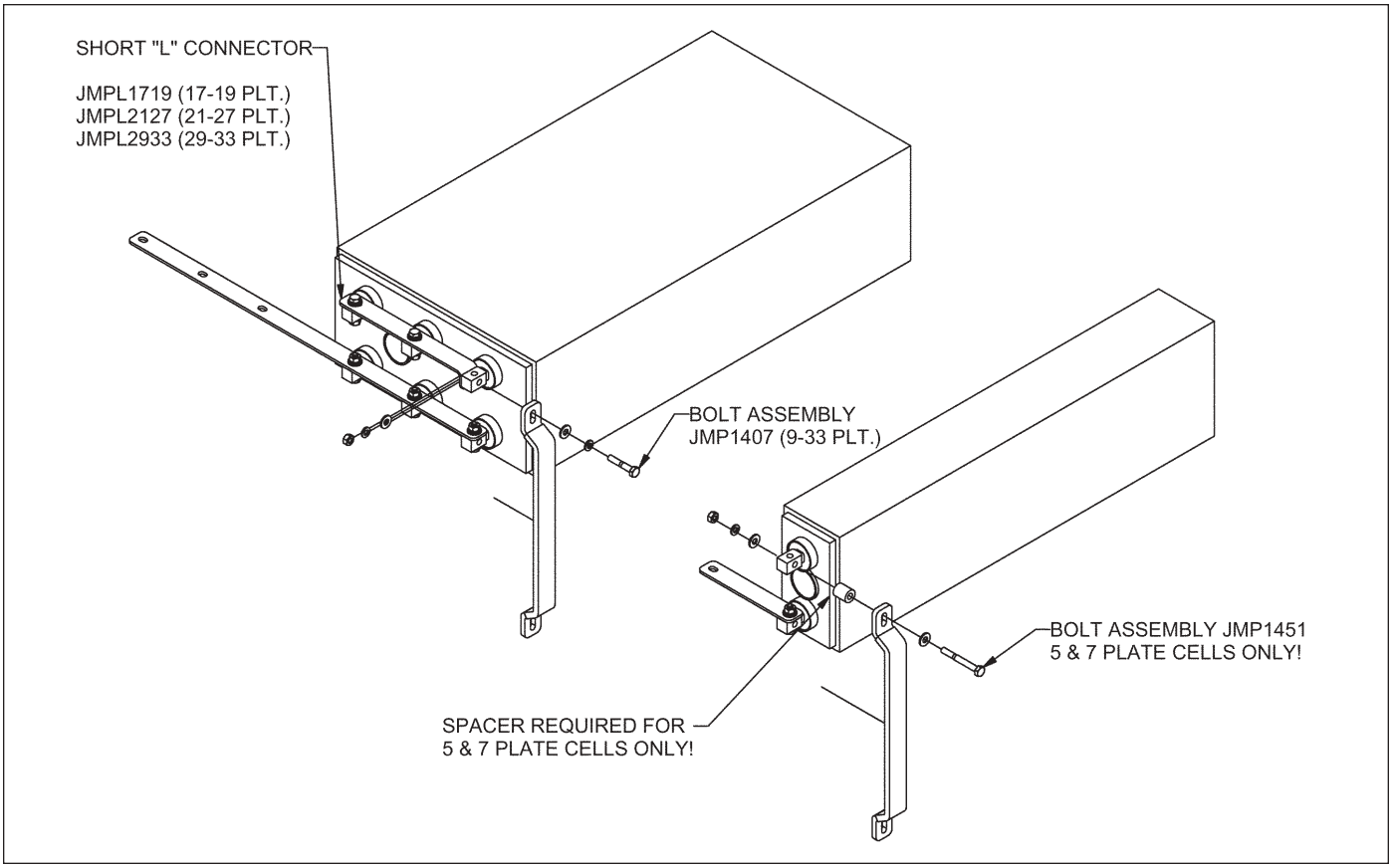
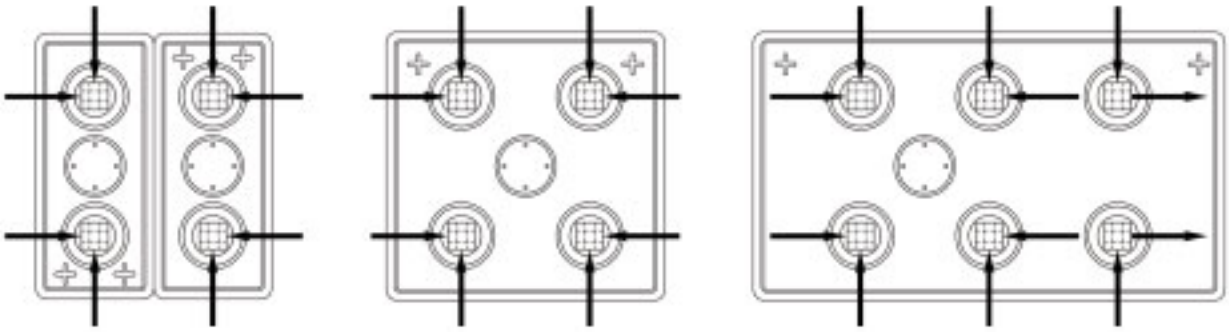

SHORT "L" CONNECTOR
JMPL1719 (17-19 PLT.)
JMPL2127 (21-27 PLT.)
JMPL2933 (29-33 PLT.)
BOLT ASSEMBLY
JMP1407 (9-33 PLT.)
BOLT ASSEMBLY JMP1451
5 & 7 PLATE CELLS ONLY!
SPACER REQUIRED FOR
5 & 7 PLATE CELLS ONLY!

*Fig. 4-3*

**RECOMMENDED BOLT DIRECTION**



**5-15 PLATE** **17-27 PLATE** **29-33 PLATE**

**NOTES: INSULATED TORQUE WRENCH SHOULD BE PLACED ON BOLT HEAD TO ENSURE MAXIMUM CLEARANCE.**

*Fig. 4-4*

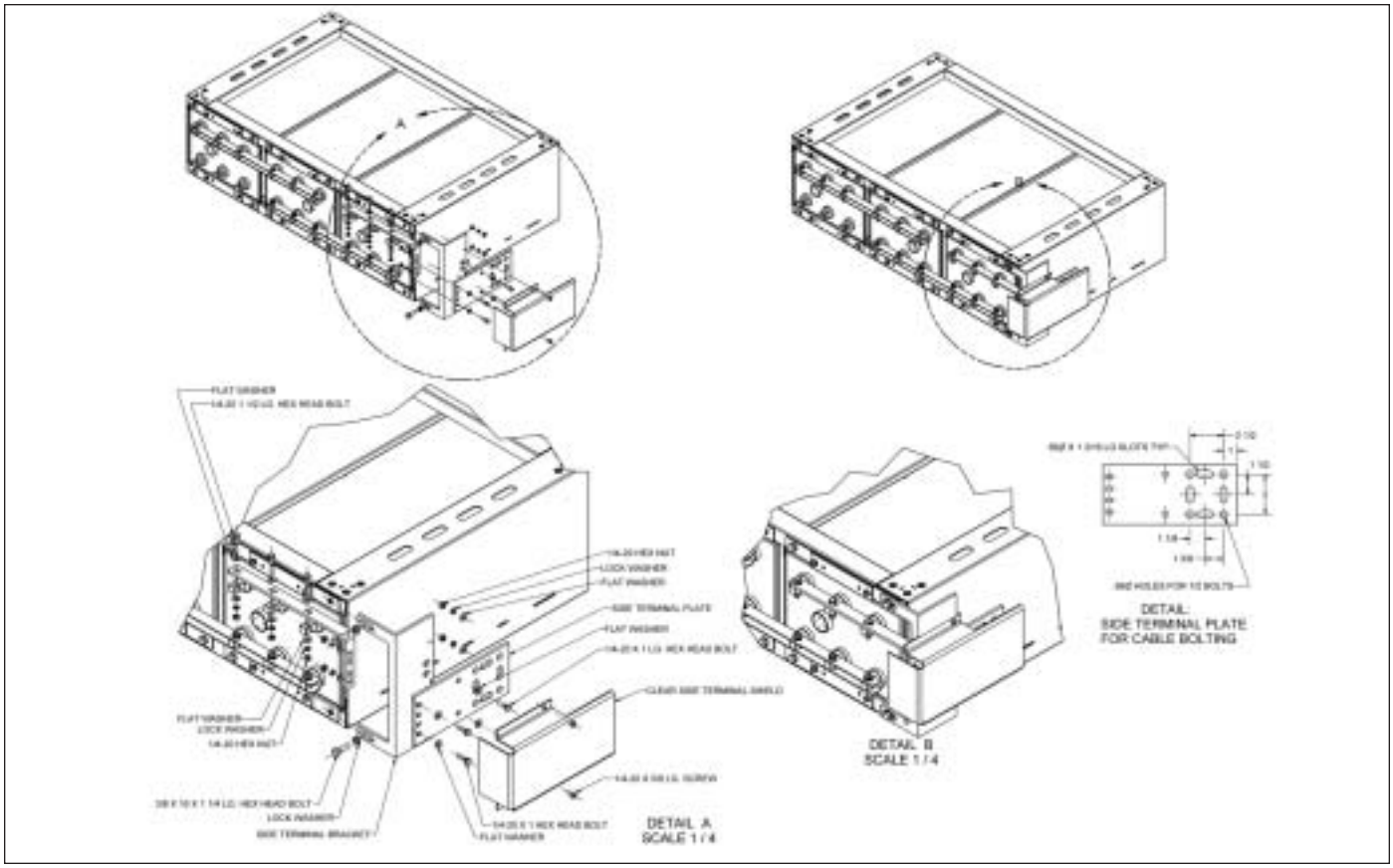



*Fig. 4-6*

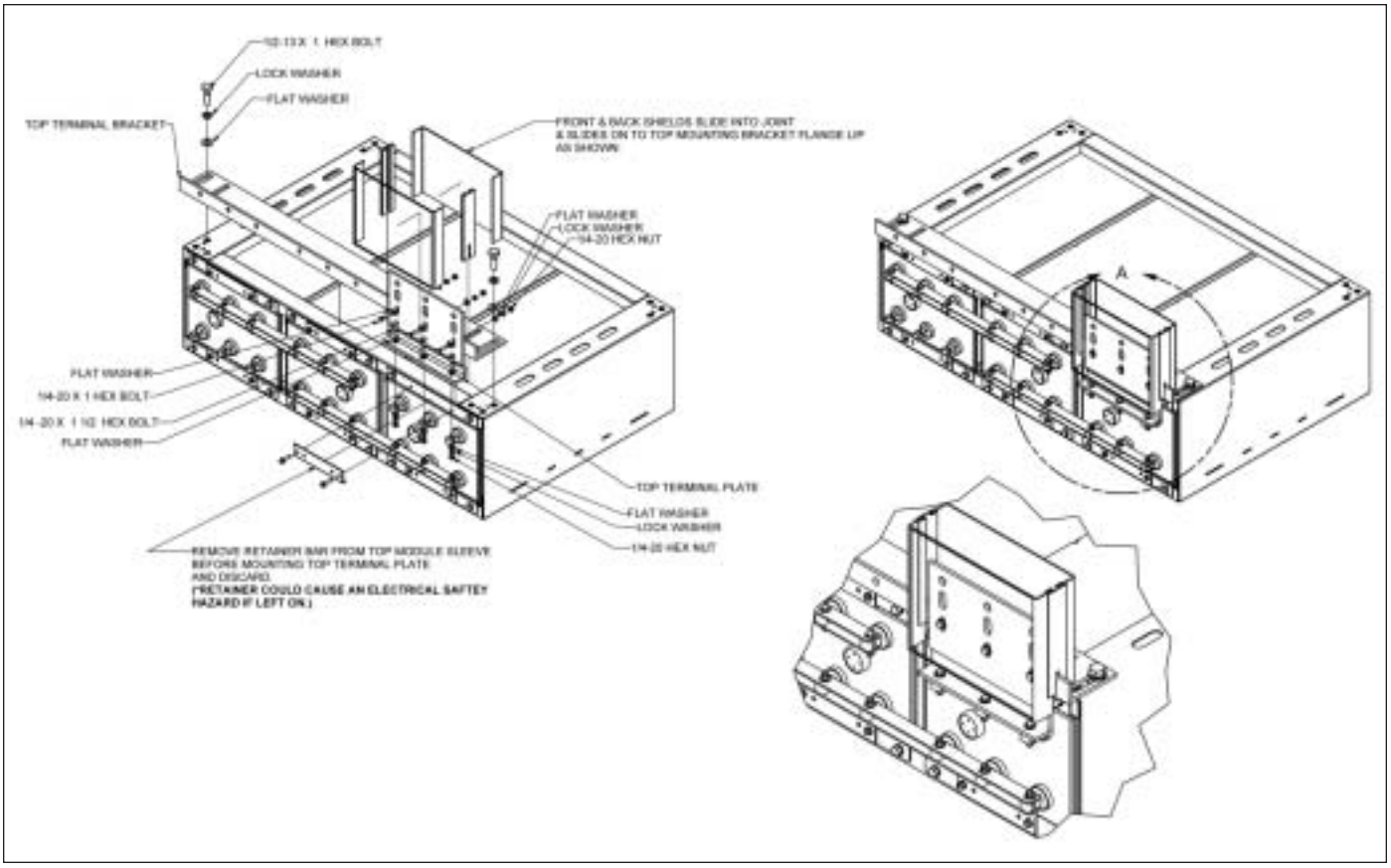

LOCK WASHER
FLAT WASHER
TOP TERMINAL BRACKET
FRONT & BACK SHIELDS SLIDE INTO JOINT & SLIDES ON TO TOP MOUNTING BRACKET FLANGE UP AS SHOWN
FLAT WASHER
LOCK WASHER
1/4-20 HEX NUT
FLAT WASHER
1/4-20 X 1 HEX BOLT
1/4 -20 X 1 1/2 HEX BOLT
FLAT WASHER
TOP TERMINAL PLATE
FLAT WASHER
LOCK WASHER
1/4-20 HEX NUT
REMOVE RETAINER BAR FROM TOP MODULE SLEEVE BEFORE MOUNTING TOP TERMINAL PLATE AND DISCARD.
(RETAINER COULD CAUSE AN ELECTRICAL SAFTEY HAZARD IF LEFT ON.)
A

*Fig. 4-7*

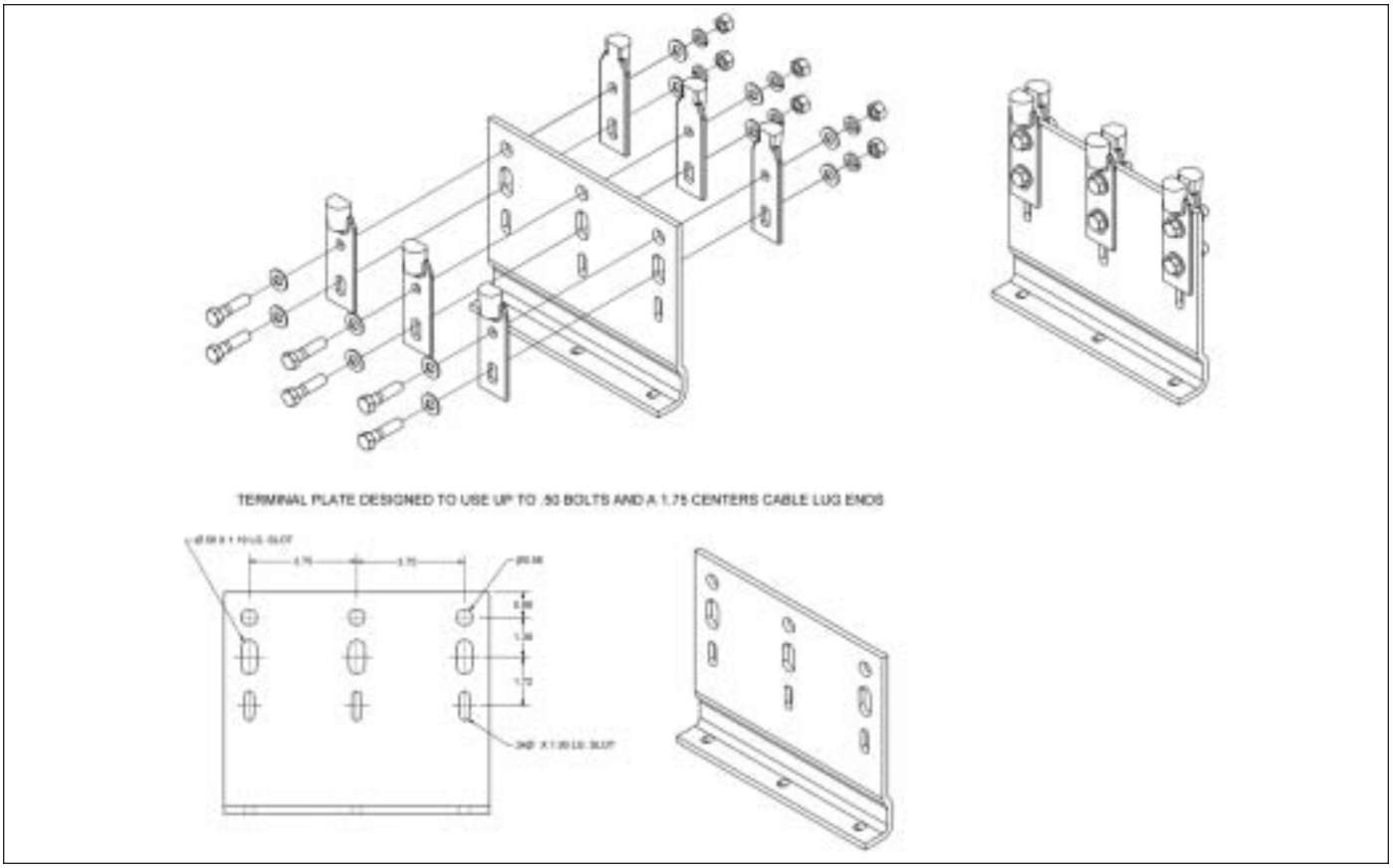

TERMINAL PLATE DESIGNED TO USE UP TO .50 BOLTS AND A 1.75 CENTERS CABLE LUG ENDS

*Fig. 4-8*

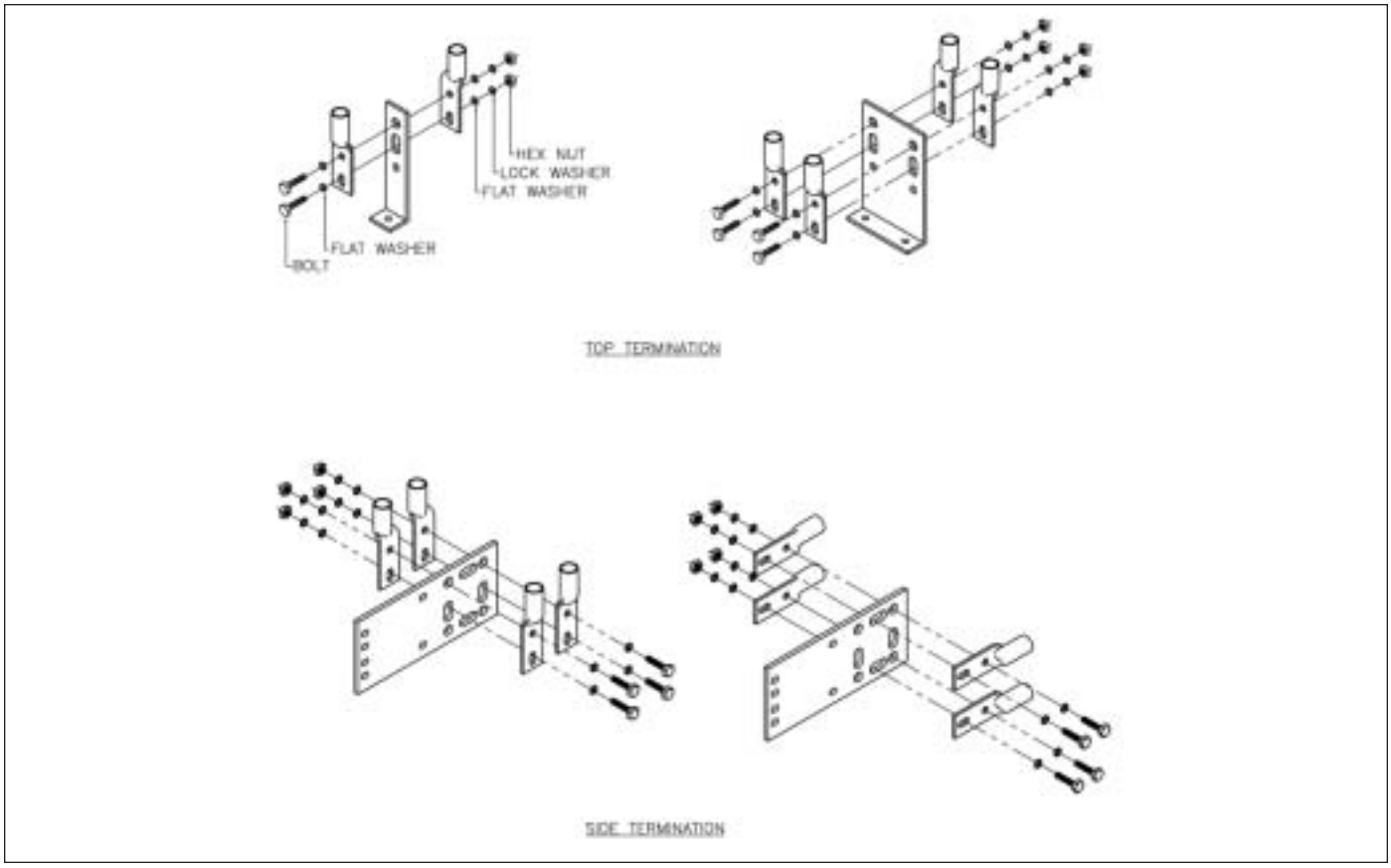



*Fig. 4-9*

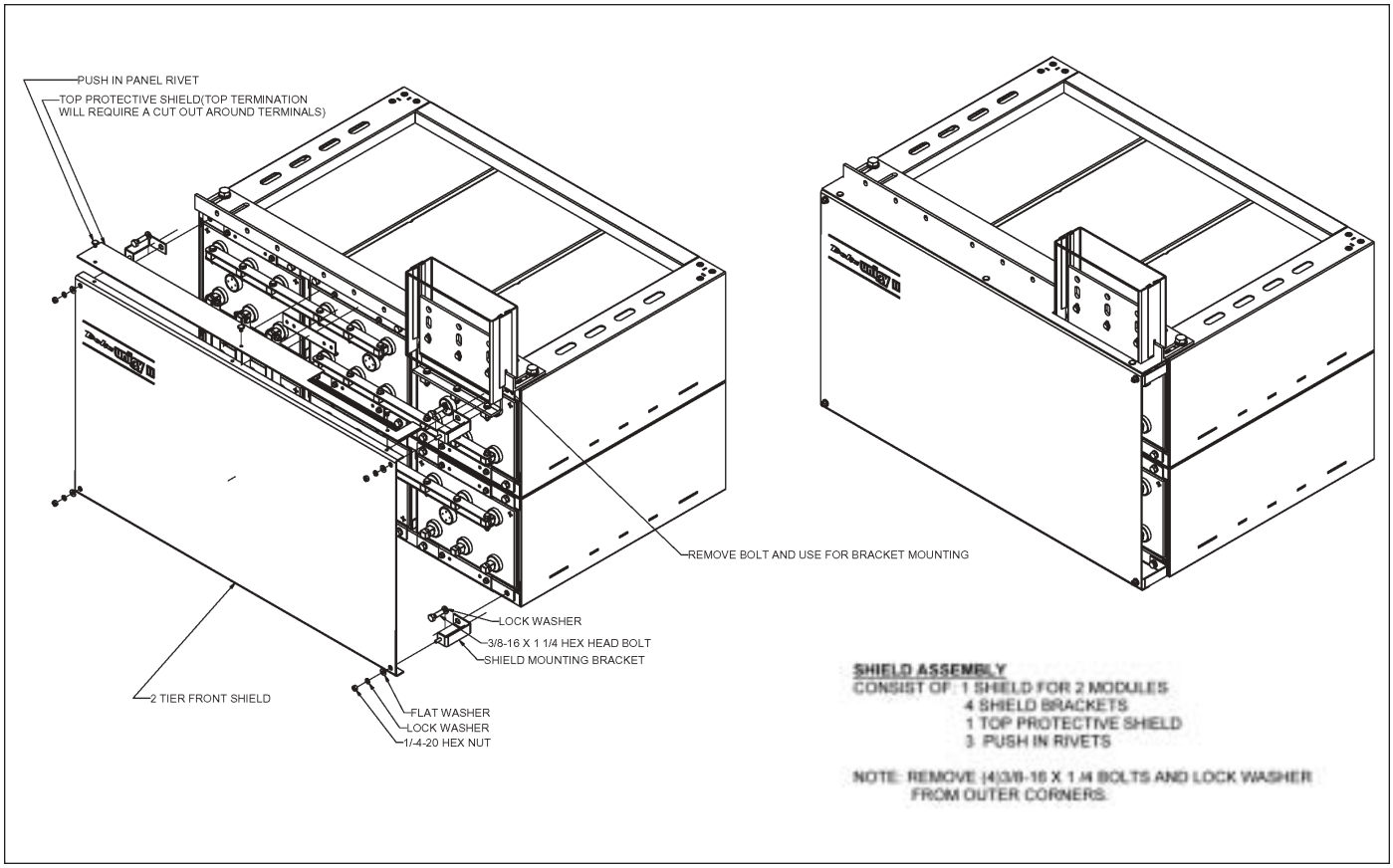



*Fig. 4-10*

# – Material Safety Data Sheet –
# LEAD ACID BATTERY WET, FILLED WITH ACID

## SECTION I

**Manufacturer's Name:** East Penn Manufacturing Co., Inc. Deka Road, Lyon Station, PA 19536
**Telephone Number for Information:** (610) 682-6361
**Emergency Telephone Number: CHEMTREC:** 1-800-424-9300,
In Washington D.C. or outside continental U.S., call 1-202-483-7616
**Date:** March 16, 2005
**Trade Name:** Electric Storage battery, SLI or Industrial battery
**Classification:** Battery wet, filled with acid, electric storage
UN2794

## SECTION II
## HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

| Hazardous Components Specific Chemical Identity [Common Name(s)] | OSHA PEL | ACGIH TLV | Range Percent by Weight | Average |
|---|---|---|---|---|
| Lead, CAS #7439921 | 0.05 mg/m$^3$ | 0.05 mg/m$^3$ | 43-70 | 65 |
| Sulfuric Acid, CAS #7664939 | 1.00 mg/m$^3$ | 1.00 mg/m$^3$ | 20-44 | 25 |
| Antimony, CAS #7440360 | 0.50 mg/m$^3$ | 0.50 mg/m$^3$ | 0-4 | <1 |
| Arsenic, CAS #7440382 | 0.01 mg/m$^3$ | 0.01 mg/m$^3$ | <.01 | — |
| Polypropylene, CAS #9003070 | — | — | 5-10 | 8 |
| Calcium, CAS #7440702 | 1.0 mg/m$^3$ | 1.0 mg/m$^3$ | <1 | <1 |

## SECTION III
## PHYSICAL/CHEMICAL CHARACTERISTICS

**Electrolyte (Sulfuric Acid):**
**Appearance and Odor:** Clear, Odorless, Colorless
**Boiling Point:** approximately 235°F
**Evaporation Rate (Butyl Acetate=1):** less than 1.0
**Melting Point:** N/A
**Solubility in Water:** Completely
**Specific Gravity ($H_20$=1):** 1.220 – 1.325
**Vapor Density (AIR=1):** N/A
**Vapor Pressure (mm Hg):** 13

## SECTION IV
## FIRE AND EXPLOSION HAZARD DATA

**Flash Point (Method Used):** Non-Flammable
**Flammable Limits:** *Hydrogen Gas
**Extinguishing Media:** Class ABC extinguisher, $CO_2$
**LEL:** 4% **UEL** 74%
**Special Fire Fighting Procedures:** Cool exterior of battery if exposed to fire to prevent rupture. The acid mist and vapors in a fire situation are corrosive. Wear special respiratory protection (SCBA) and clothing.
**Unusual Fire and Explosion Hazards:** *Hydrogen gas, which may explode if ignited, is produced by this battery, especially when charging. Use adequate ventilation; avoid open flames, sparks, or other sources of ignition.

## SECTION V
## REACTIVITY DATA

**Stability:** Stable **Condition to Avoid:** Prolonged overcharging, sources of ignition
**Incompatibility (Materials to Avoid):** Sulfuric Acid: Contact with combustibles and organic materials may cause fire and explosion. Also reacts violently with strong reducing agents, metals, strong oxidizers and water. Contact with metals may produce toxic sulfur dioxide fumes and may release flammable hydrogen gas.
**Hazardous Decomposition of By-Products:** Sulfuric Acid: Excessive overcharging or fire may create Sulfur trioxide, carbon monoxide, sulfuric acid mist, sulfur dioxide, and hydrogen.
Lead Compounds: Contact with strong acid or base or presence of nascent hydrogen may generate highly toxic arsine gas.

## SECTION VI
## HEALTH HAZARD DATA

**Route(s) of Entry:** Not Applicable under normal use. (Inhalation, skin contact, and ingestion)
**Health Hazards (Acute and Chronic):** Do not open battery, avoid contact with internal components. Internal components are Oxide lead and electrolyte. Short term exposure: Sulfuric acid may cause irritation of eyes, nose, and throat. Prolonged contact may cause severe burns. Long term exposure: Repeated contact causes irritation and skin burns. Repeated exposure to mist may cause erosion of teeth, chronic eye irritation and/or chronic inflammation of the nose, throat, and bronchial tubes.
*TARGET ORGAN:* (Electrolyte) respiratory system, eyes, skin, and teeth
**Carcinogenicity:**
Sulfuric Acid: The International Agency for Research on Cancer (IARC) has classified "strong inorganic acid mist containing sulfuric acid" as a Category 1 carcinogen, a substance that is carcinogenic to humans. This classification does not apply to liquid forms of sulfuric acid contained within a battery. Inorganic acid mist (sulfuric acid mist) is not generated under normal use of this product. Misuse of the product such as

*continued*

## SECTION VI
## HEALTH HAZARD DATA (continued)

overcharging, may result in the generation of sulfuric acid mist.
Lead Compounds: Lead is listed as a 2B carcinogen, likely in animals at extreme doses. Proof of carcinogenicity in humans is lacking at present.
Arsenic: Listed by National Toxicology Program (NTP), IARC, OSHA and NIOSH as a carcinogen only after prolonged exposure at high levels.
**Signs and Symptoms of Exposure:** Acid contact may cause irritation of eyes, nose and throat. Breathing of mist may produce respiratory difficulty. Contact with eyes and skin causes irritation and skin burns. Sulfuric acid is a CORROSIVE chemical.
**Medical Conditions Generally Aggravated by Exposure:** Sulfuric Acid Mist exposure may aggravate medical conditions such as, pulmonary edema, bronchitis, emphysema, dental erosion, and tracheobronchitis. Pregnant women and children must be protected from lead exposure.
**Emergency and First Aid Procedures:** (Sulfuric Acid)

1) Flush contacted area with large amounts of water for at least 15 minutes. Remove contaminated clothing and obtain medical attention if necessary. Eye wash and/or emergency shower should be readily available.
2) If swallowed, give large volumes of water. **DO NOT** induce vomiting, obtain medical treatment.

## SECTION VII
## PRECAUTIONS FOR SAFE HANDLING AND USE

**Steps to be Taken in Case Material is Released or Spilled:** *SULFURIC ACID:* Dilute spill cautiously with five to six volumes of water and gradually neutralize with sodium bicarbonate, soda ash or lime. When exposure level is not known, wear NIOSH approved positive pressure self-contained breathing apparatus. Reference North American Emergency Response Guidebook, #154.
**Waste Disposal Method:** Lead-acid batteries are completely recyclable. For information on returning batteries to East Penn for recycling, contact your East Penn Representative. Dispose of any collected material in accordance with local, state or applicable federal regulations.
**Precautions to be Taken in Handling and Storing:** Store away from reactive material as defined in Section V, Reactivity Data. Place cardboard between layers of stacked batteries to avoid damage and short circuit. Do not allow metallic materials to simultaneously contact both terminals.
**Other Precautions:** Sodium bicarbonate, soda ash, sand, or lime should be kept in same general area for emergency use. Keep away from sources of ignition during charging see Section IV on generation of hydrogen gas. If battery case is broken, avoid direct contact with internal components.

## SECTION VIII
## CONTROL MEASURES

**Respiratory Protection (Specific Type):** Respirator required when PEL is exceeded or employee witnesses respiratory irritation. (see Section VI, Health Hazard Data).
**Ventilation:** Must be provided when charging in an enclosed area. (29CFR1910.178(g) and .305(j)(7)
Mechanical (general): Acceptable at 1 to 4 air exchanges/hour or to maintain air concentrations below the PEL.
Local Exhaust: Preferred
Other: Local building/fire codes may require explosion proof fans and equipment

**Protective Gloves:** Acid resistant
**Eye Protection:** Preferred, safety glasses, goggles, face shield
**Other Protective Clothing or Equipment:** Acid resistant aprons, boots, and protective clothing
**Work Hygienic Practices:** Good Personal hygiene and work practices are mandatory.

## SECTION XI
## OTHER REGULATORY INFORMATION

| NFPA Hazard Rating | Sulfuric Acid | Lead |
|---|---|---|
| Health (Blue) | 3 | 3 |
| Flammability (Red) | 0 | 0 |
| Reactivity (Yellow) | 2 | 0 |

Note: Sulfuric acid is water-reactive if concentrated.

**U.S. DOT:** Battery Wet, Filled with Acid

| | |
|---|---|
| Hazard Class/Division | 8 |
| ID Number | UN2794 |
| Packing Group | III |
| Label Requirement | Corrosive |

**RCRA:** Spent lead-acid batteries are not regulated as hazardous waste when recycled. Spilled sulfuric acid is a characteristic hazardous waste, EPA hazardous waste number D002 (corrosivity).
**CERCLA (Superfund) and EPCRA (Emergency Planning and Community Right to Know ACT)**

a) Reportable Quantity (RQ) for spilled 100% sulfuric acid is 1000 lbs.
b) Sulfuric acid is a listed "Extremely Hazardous Substance" under EPCRA with a Threshold Planning Quantity (TPQ) of 1000 lbs.
c) EPCRA Section 312 Tier II reporting required for batteries if sulfuric acid is present in quantities of 500 lbs. or more and/or lead is present in quantities of 10,000 lbs. or more.

**California Prop 65:** 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.**

For additional information concerning East Penn Manufacturing Co., Inc. products or questions concerning the content of this MSDS please contact your East Penn representative.
This information is accurate to the best of East Penn Mfg. Co.'s knowledge or obtained from sources believed by East Penn to be accurate. Before using any product, read all warnings and directions on the label.

## APPENDIX B

# BATTERY MAINTENANCE REPORT

Date _____

Company _____

Address _____

Battery Location and/or Number _____

No. of Cells _____ Type _____ Date Mfg. _____ Date Installed _____

Charger Output _____ Ambient Air Temperature _____ °F

Total Battery Voltage _____ Panel Meter Volts _____ Installer _____

### INDIVIDUAL CELL READINGS

| Cell No. | Serial No. | Volts | Cell Ohmic Value | Connector Ohmic Value | Cell No. | Serial No. | Volts | Cell Ohmic Value | Connector Ohmic Value | Cell No. | Serial No. | Volts | Cell Ohmic Value | Connector Ohmic Value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | 21 | | | | | 41 | | | | |
| 2 | | | | | 22 | | | | | 42 | | | | |
| 3 | | | | | 23 | | | | | 43 | | | | |
| 4 | | | | | 24 | | | | | 44 | | | | |
| 5 | | | | | 25 | | | | | 45 | | | | |
| 6 | | | | | 26 | | | | | 46 | | | | |
| 7 | | | | | 27 | | | | | 47 | | | | |
| 8 | | | | | 28 | | | | | 48 | | | | |
| 9 | | | | | 29 | | | | | 49 | | | | |
| 10 | | | | | 30 | | | | | 50 | | | | |
| 11 | | | | | 31 | | | | | 51 | | | | |
| 12 | | | | | 32 | | | | | 52 | | | | |
| 13 | | | | | 33 | | | | | 53 | | | | |
| 14 | | | | | 34 | | | | | 54 | | | | |
| 15 | | | | | 35 | | | | | 55 | | | | |
| 16 | | | | | 36 | | | | | 56 | | | | |
| 17 | | | | | 37 | | | | | 57 | | | | |
| 18 | | | | | 38 | | | | | 58 | | | | |
| 19 | | | | | 39 | | | | | 59 | | | | |
| 20 | | | | | 40 | | | | | 60 | | | | |

Remarks and Recommendations _____

Readings Taken By _____

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

**Notation: This form must be completed and submitted with any product warranty claim.**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