Deka® unigy® II

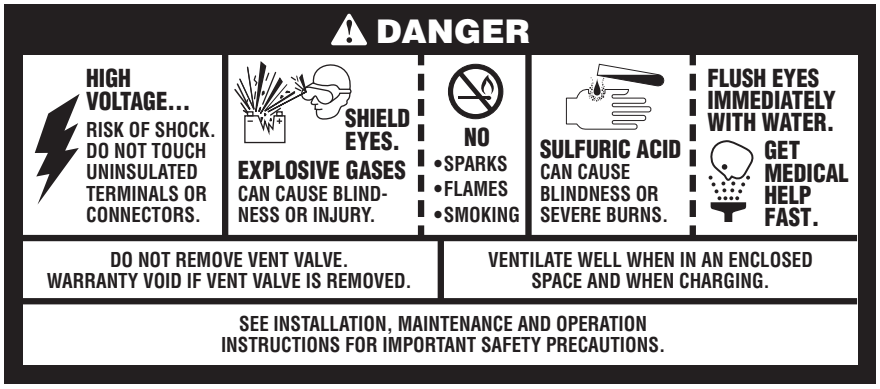
SPACESAVER® SYSTEMS

Interlock™ 45, 75, 95 & 125 AH
Non-Interlock™ 45, 75 & 95 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.**

TABLE OF CONTENTS



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

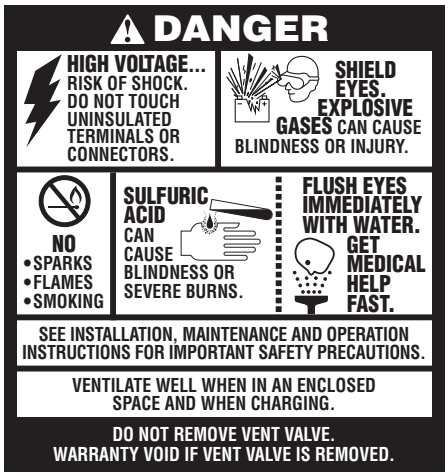
The following safety procedures should be followed during installation: **(Always wear safety glasses or face shield when working on or near batteries. Refer to Fig. 1-1, pg. 3)**

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: CO_2 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.

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.



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 all batteries for visible defects such as cracked containers, looser 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. (See Fig. 2-1, pg. 8.)
4. Never lift the batteries by the terminal posts. (See Fig. 3-1, pg. 8.)
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 at a time by the module mounting holes.

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 the date of manufacture to prevent permanent performance degradation. Record dates and conditions for all charges during storage.
3. Do not store beyond 12 months.
4. Store in horizontal position only.

INSTALLATION

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.

INSTALLATION *(con't)*

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.

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. 3-2, pg. 9.)

1. UBC Zone 4 hardware included for Interlock™ module assembly (45, 75 & 95 AH). (See Fig. 3-4, pg. 10)
2. Unbolt the floor-mounting channel from the top of the battery.
3. Use the two slings provided to lift modules. Note: For Interlock™ module lift the top module slightly and slide front. (This will release the interlock tabs and will free itself from the remaining stack.) (See Fig. 3-2, pg. 9)
4. For the Non-Interlock modules, reference figure 3.5, pg. 11 for marking hole locations to mount base supports to floor. For the Interlock modules, use 1-piece base for marking floor hole location. **(See local building codes for anchor bolt requirements, anchor bolts not included.)**
5. Remove the next module in the same manner as the first. Place in position. Note: For Interlock™ module slide back allowing the tabs to lock in place. (No rear bolts required) (See Fig. 3-2, pg. 9)
6. Each battery is shipped with its own schematic. Make sure the polarity on the batteries 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 Interlock™ and Non-Interlock™ battery (45, 75 & 95 AH) are supplied with connector package "1CU" requiring one connector 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, 4-2 and 4-3 pg. 11 and 12; Fig. 4-4, pg. 4. For proper direction when inserting into posts.) The 125 AH battery is supplied with a 2CU connector package as standard. (Refer to Fig.5-1A, pg. 13 for special connector orientation for side terminal & stack to stack connections.)
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. 4-4

Connector Packages

Standard Package (45, 75 & 95 AH)
1CU: (1) ⅜" connector / post
≤ 250 amps / 480 wpc (5-15 plate)
≤ 450 amps / 720 wpc (17-27 plate)
≤ 550 amps / 880 wpc (29-33 plate)
Optional Packages
2CU: (2) ⅜" connectors / post (Standard on 125 AH)
≤ 1000 amps / 1600 wpc (9-33 plate)
4CU: (4) ⅜" connectors / post
≤ 2000 amps / 3200 wpc (13-33 plate)
6CU: (6) ⅜" connectors / post
≤ 3000 amps / 4800 wpc (25-33 plate)
Corresponding Bolt Package
1CU: ¼-20 x 1¼" long — JMP1428
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. 5-1, pg. 13 for Interlock™ and Fig. 5-2 and 5-2A for Non-Interlock™, pg. 14 for Side Terminal; See Fig. 5-3 and Fig. 5-3A, pg. 15 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). (See Fig. 5-3 and Fig. 5-3A, pg. 15 for 95 AH vs. 125 AH)
3. For cable connection assembly, (See Fig. 7-1, pg. 16 and Fig. 7-1A, pg. 17.)

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 C 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.).
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. Attach one black clip to each end of the clear shield. (See Fig. 5-4, pg. 16 and 5-5, pg. 5.)
2. Install the fully assembled shield into the tabs on the module. (See Fig. 5-6, pg. 5 & Fig. 5-4, pg. 16)

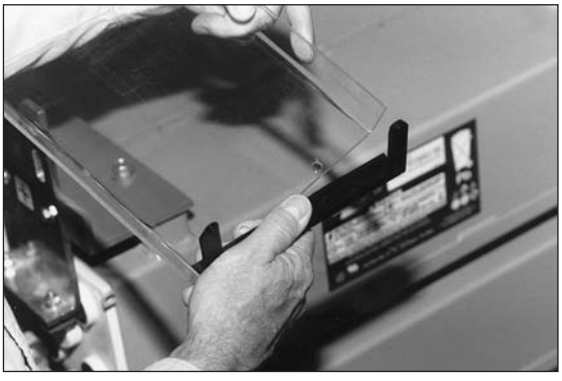


Fig. 5-5

Top Protective Shield Assembly

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

For top terminal assembly, cut the black protective cover to fit between the terminals and then attach to the front shield. (See Fig. 5-4, pg. 16.)

Terminal Plate Shield Assembly

For side terminal shield assembly, (Refer to Fig. 5-1, pg 13 for Interlock™ and Fig. 5-2 and 5-2A for Non-Interlock™, pg. 14 and Fig. 5-7, pg. 5)

For top terminal shield assembly, (Refer to Fig. 5-3, pg. 15 and Fig. 5-8, pg. 5)

Fig. 5-6

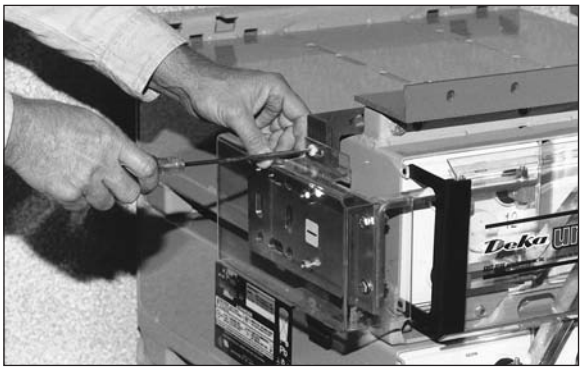


Fig. 5-7

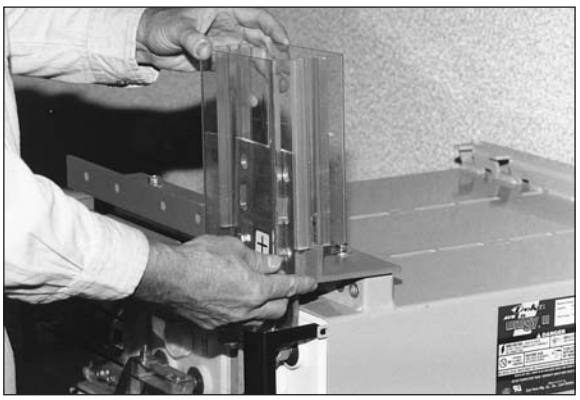


Fig. 5-8

SYSTEM OPERATIONS

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 cell float voltage times the number of cells per string. 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.

Operating Temperatures

Battery Temperature		Float Voltage per Cell	
°F	°C	AVR45, 75, 95, 125	AVR125LG
50˚	10˚	2.25	2.21
59˚	15˚	2.25	2.21
68˚	20˚	2.25	2.21
77˚	25˚	2.25	2.21
86˚	30˚	2.25	2.21
95˚	35˚	2.23	2.19

Cell Voltage

Although the charger must maintain the system 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, an optional boost charge of: **2.30 VPC ± .01 volts** (AVR45/75/95/125) and **2.26 ± .01 volts** (AVR125LG) 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 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 C, 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. 6-1, pg. 6.)

Voltages, Temperatures & Ohmic Readings (con't)

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. 6-2, 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. 6-1

Fig. 6-2

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 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 lease one month. Cells should be within ± 0.05 volts of the average cell float voltage.

Annual Inspection *(con't)*

5. Record the ambient temperatures.
6. Record individual cell 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 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, 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.

CELL REMOVAL PROCEDURE

1. Before removing cells, review Safety Precautions on pg. 3 of this manual. Contact East Penn Manufacturing Company, Inc. with specific questions or concerns.
2. Refer to Fig. 8-1 through 8-4 below for specific instructions.

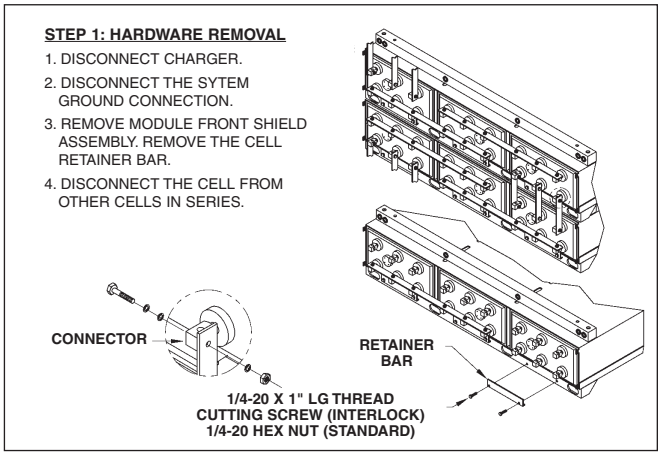


Fig. 8-1

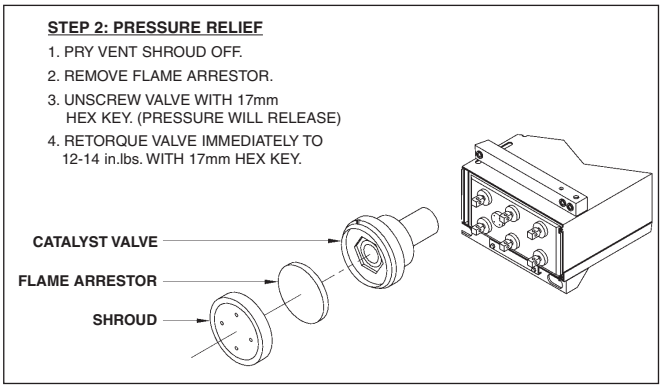


Fig. 8-2

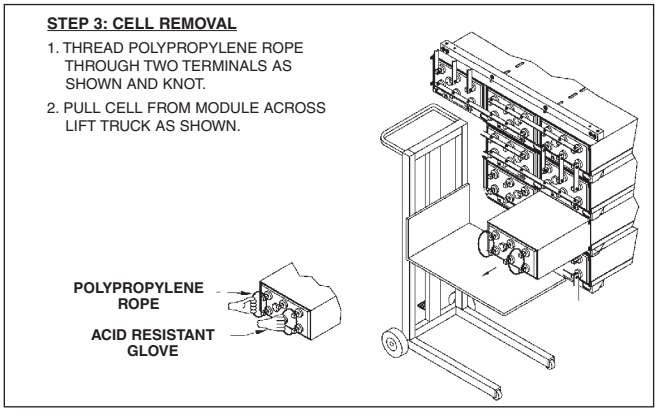


Fig. 8-3

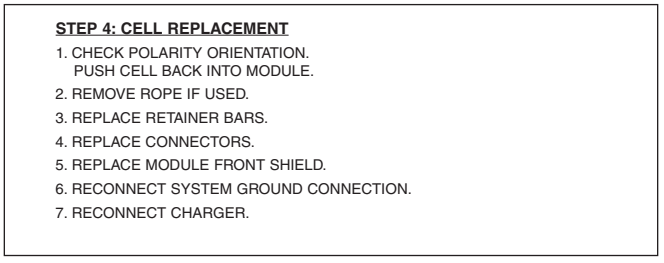


Fig. 8-4

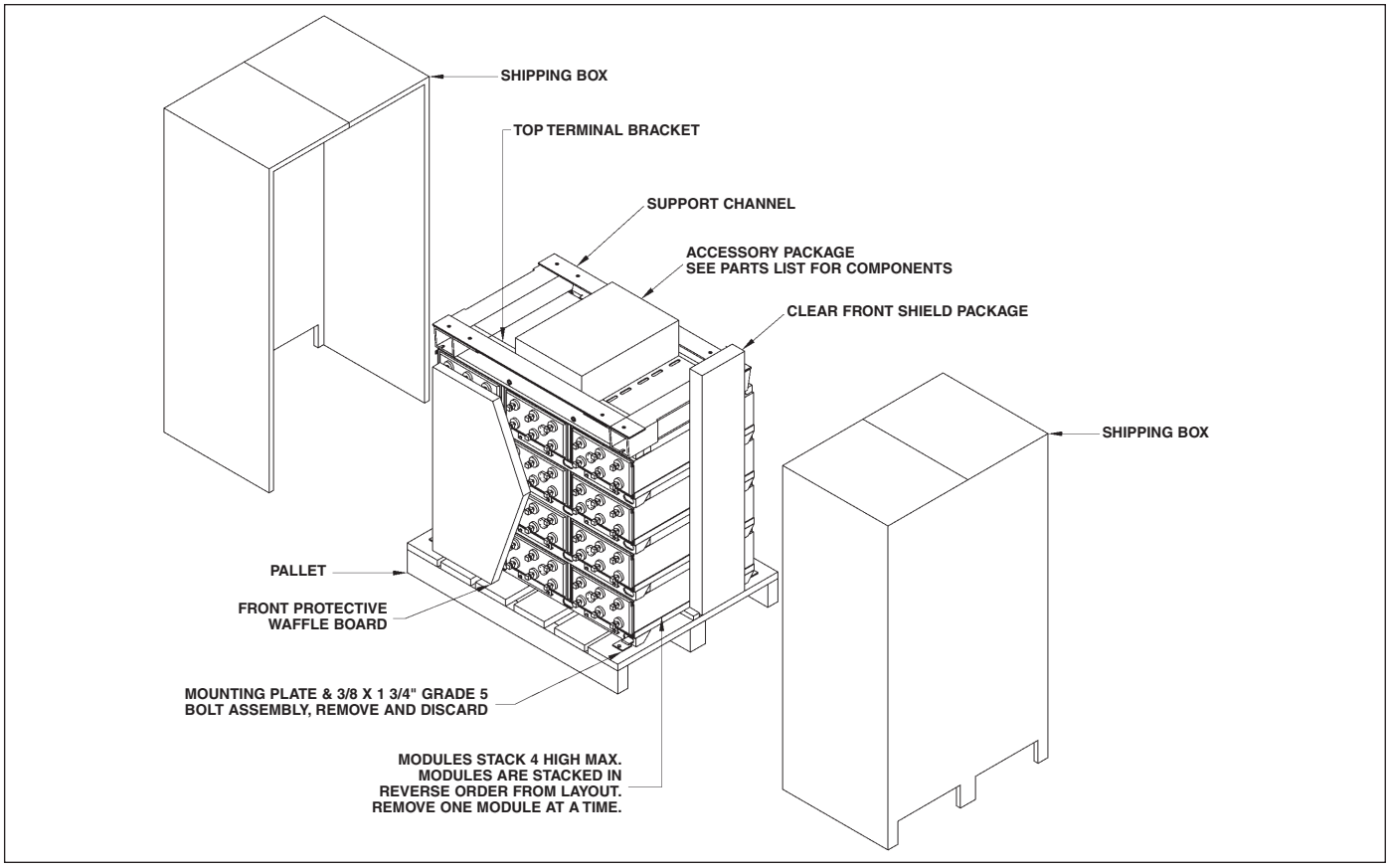

SHIPPING BOX
TOP TERMINAL BRACKET
SUPPORT CHANNEL
ACCESSORY PACKAGE
SEE PARTS LIST FOR COMPONENTS
CLEAR FRONT SHIELD PACKAGE
SHIPPING BOX
PALLET
FRONT PROTECTIVE
WAFFLE BOARD
MOUNTING PLATE & 3/8 X 1 3/4" GRADE 5
BOLT ASSEMBLY, REMOVE AND DISCARD
MODULES STACK 4 HIGH MAX.
MODULES ARE STACKED IN
REVERSE ORDER FROM LAYOUT.
REMOVE ONE MODULE AT A TIME.

Fig. 2-1

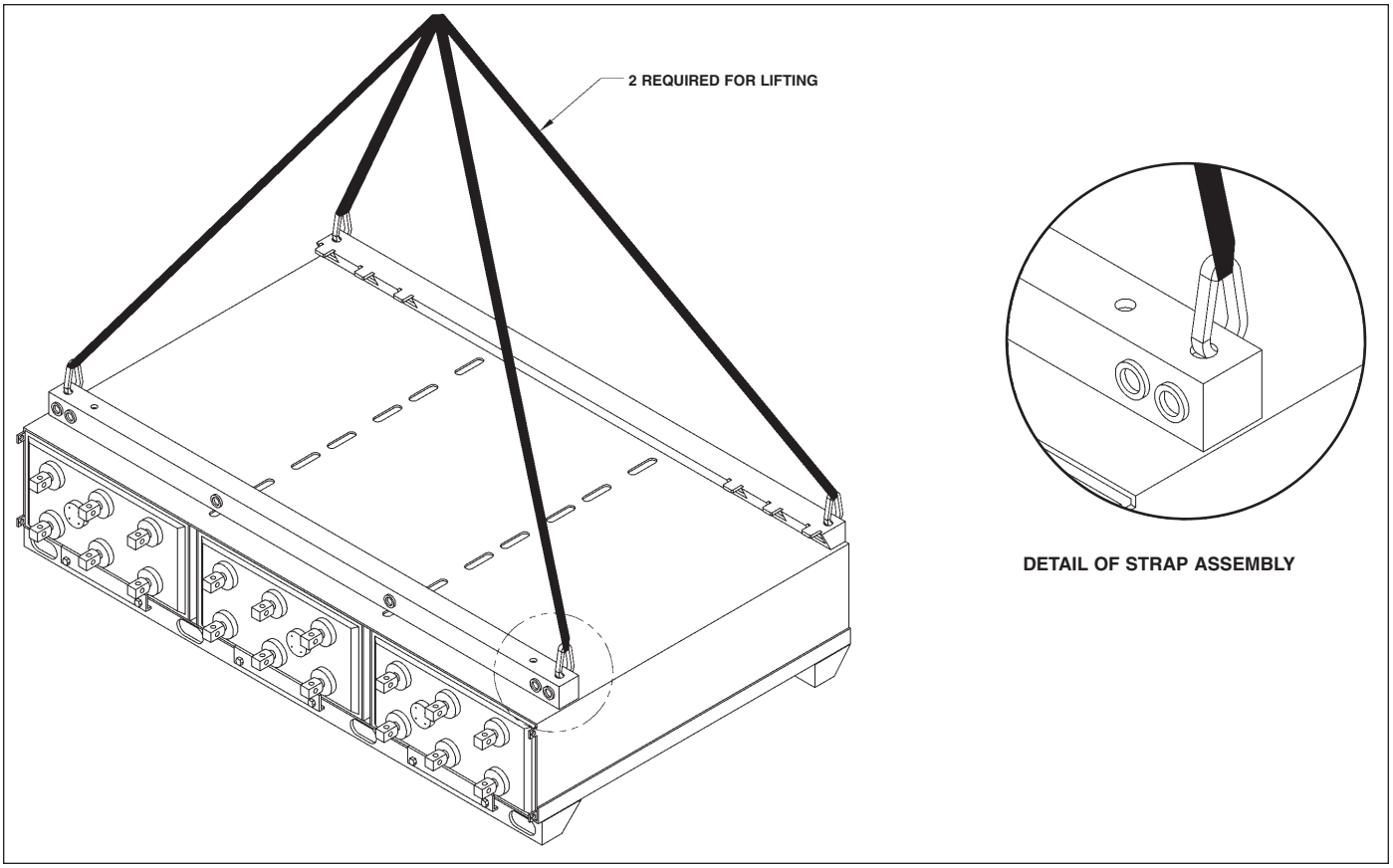

2 REQUIRED FOR LIFTING
DETAIL OF STRAP ASSEMBLY

Fig. 3-1

Interlock™ System Leveling

When leveling Unigy II Interlock™ battery systems that are installed with a 1-piece base support, it is critical to note that the back channel is 3/16" shorter than the front channel.

If a level is placed across the front and rear channels, a 3/16" shim should be placed on top of the rear channel in order to level properly.

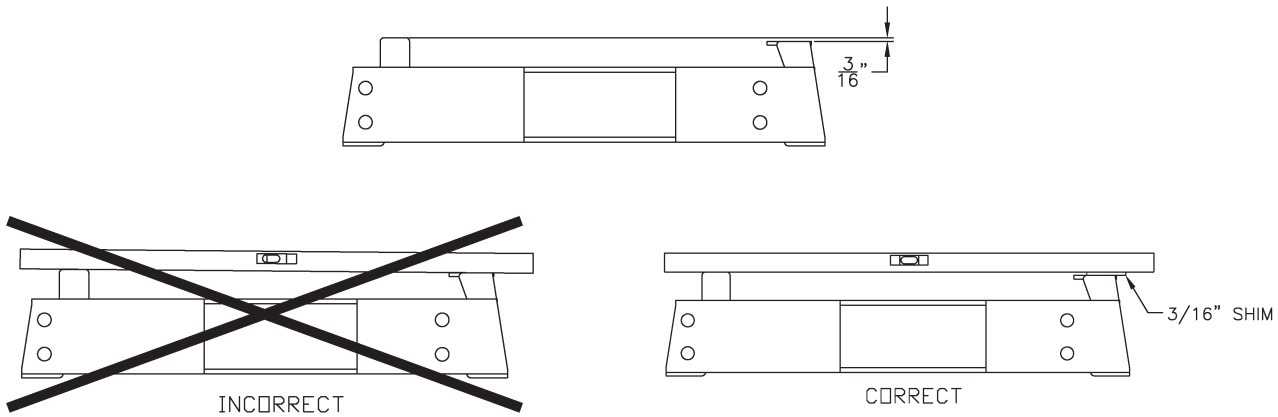


Fig. 3-1A

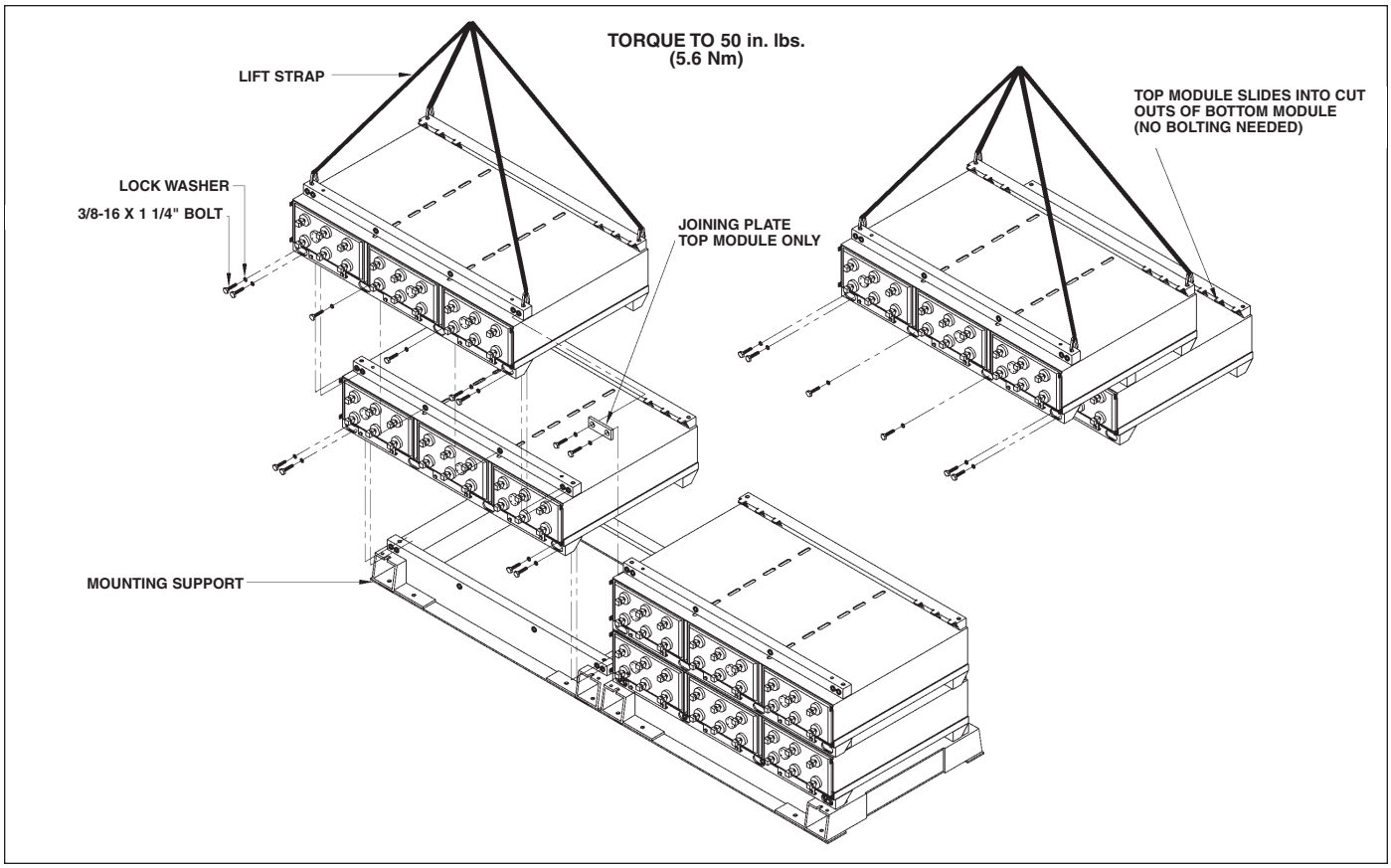


Fig. 3-2

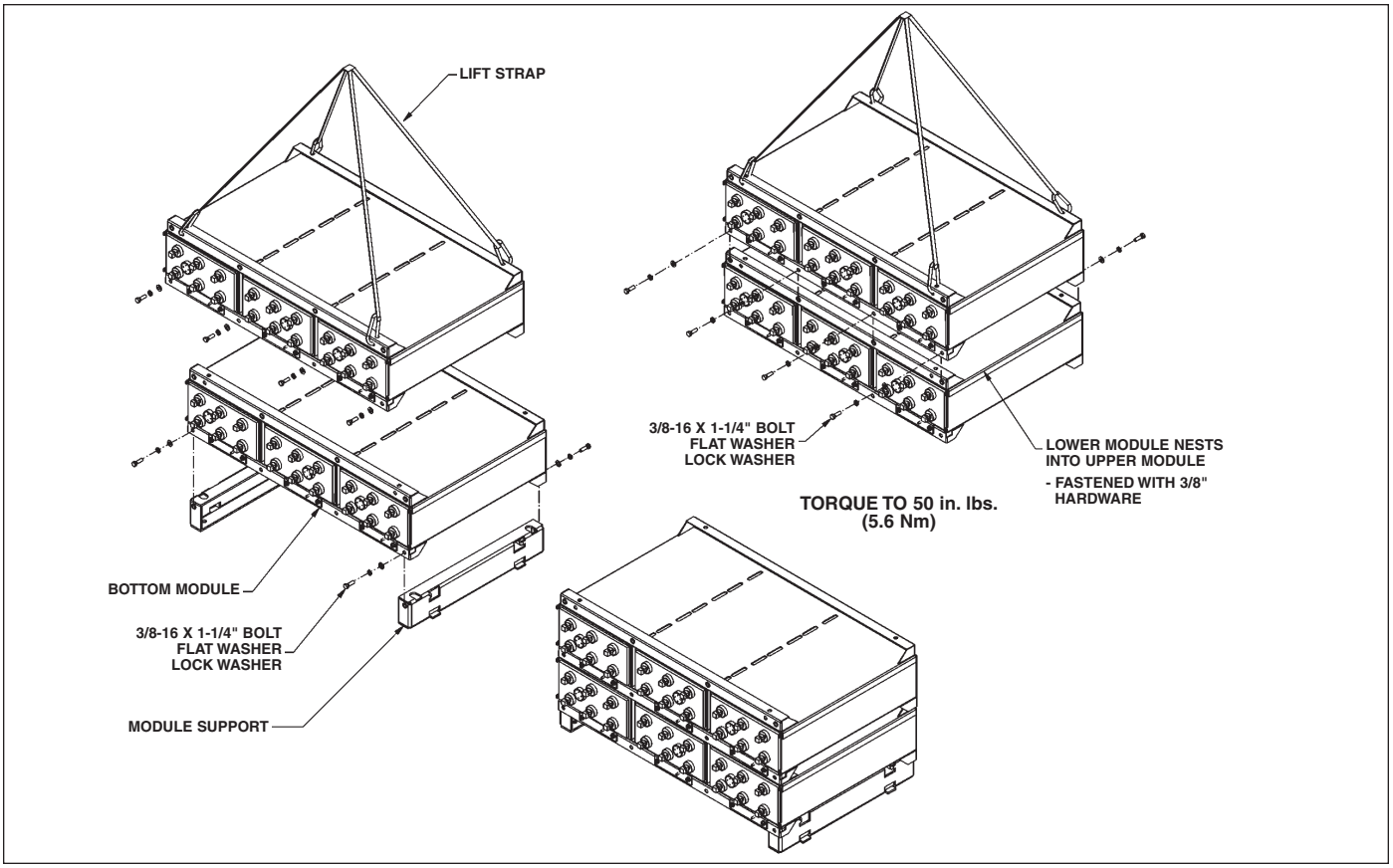

LIFT STRAP
BOTTOM MODULE
3/8-16 X 1-1/4" BOLT
FLAT WASHER
LOCK WASHER
MODULE SUPPORT
3/8-16 X 1-1/4" BOLT
FLAT WASHER
LOCK WASHER
LOWER MODULE NESTS
INTO UPPER MODULE
- FASTENED WITH 3/8"
HARDWARE
TORQUE TO 50 in. lbs.
(5.6 Nm)

Fig. 3-3

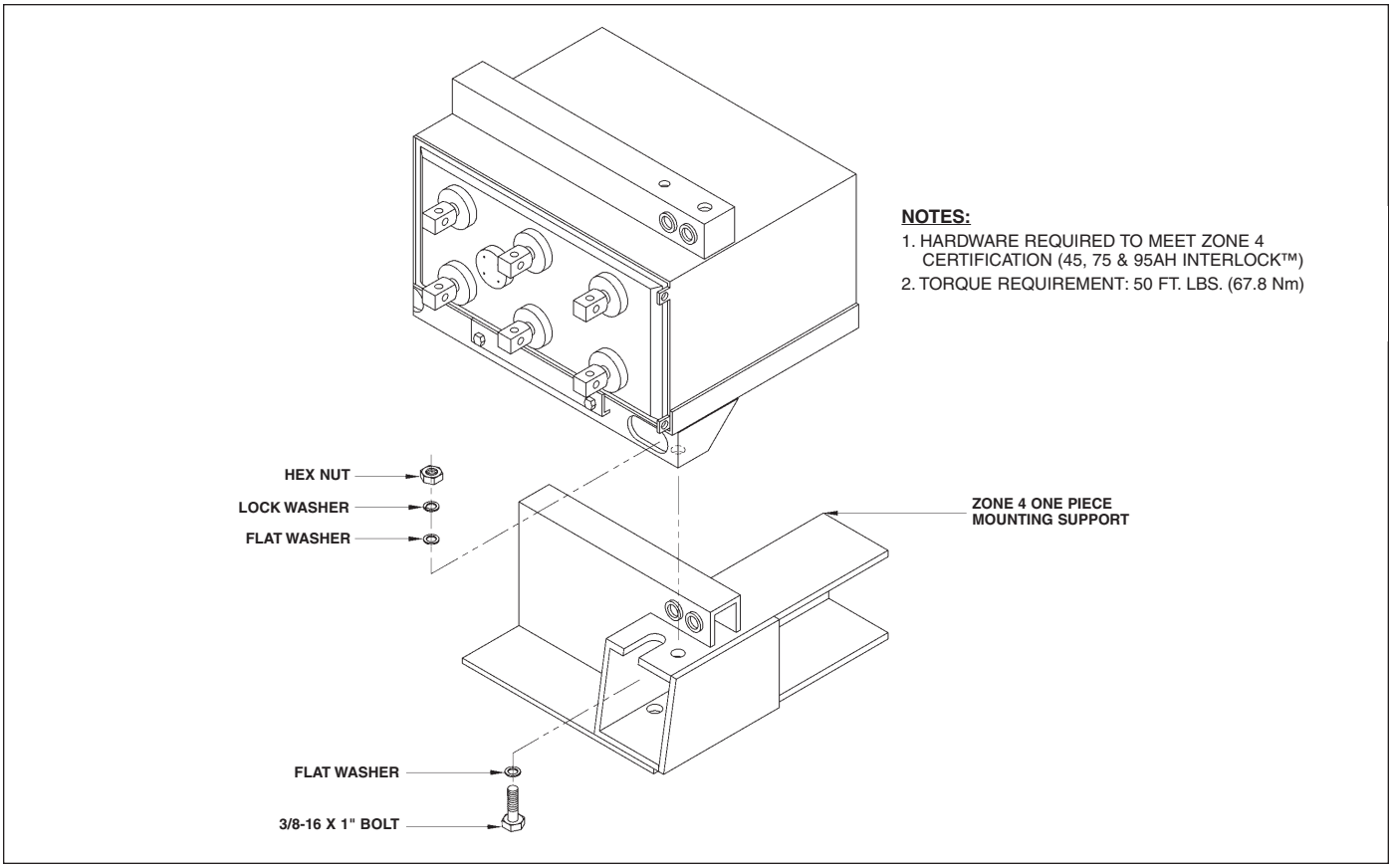

NOTES:
1. HARDWARE REQUIRED TO MEET ZONE 4
CERTIFICATION (45, 75 & 95AH INTERLOCK™)
2. TORQUE REQUIREMENT: 50 FT. LBS. (67.8 Nm)
HEX NUT
LOCK WASHER
FLAT WASHER
ZONE 4 ONE PIECE
MOUNTING SUPPORT
FLAT WASHER
3/8-16 X 1" BOLT

Fig. 3-4

NO. OF PLATES	3 & 6 CELL MODULES						2 & 4 CELL MODULES		NO. OF PLATES	3 & 6 CELL MODULES						2 & 4 CELL MODULES	
	45 A.H.		75 A.H.		95 A.H.		95 A.H.			45 A.H.		75 A.H.		95 A.H.		95 A.H.	
	X	Y	X	Y	X	Y	X	Y		X	Y	X	Y	X	Y	X	Y
5	11.72	10.64	11.72	17.74	—	—	—	—	21	—	10.64	23.57	17.74	23.57	20.34	14.80	20.34
7	16.16	10.64	16.16	17.74	16.16	20.34	9.86	20.34	23	—	10.64	25.82	17.74	25.82	20.34	16.30	20.34
9	20.66	10.64	20.66	17.74	20.66	20.34	12.86	20.34	25	—	10.64	28.07	17.74	28.07	20.34	17.80	20.34
11	25.16	10.64	25.16	17.74	25.16	20.34	15.86	20.34	27	—	10.64	30.32	17.74	30.32	20.34	19.30	20.34
13	29.66	10.64	29.66	17.74	29.66	20.34	18.86	20.34	29	—	10.64	32.57	17.74	32.57	20.34	20.80	20.34
15	34.17	10.64	34.17	17.74	34.17	20.34	21.86	20.34	31	—	10.64	34.82	17.74	34.82	20.34	22.30	20.34
17	—	10.64	19.07	17.74	19.07	20.34	11.80	20.34	33	—	10.64	37.07	17.74	37.07	20.34	23.80	20.34
19	—	10.64	21.32	17.74	21.32	20.34	13.30	20.34									

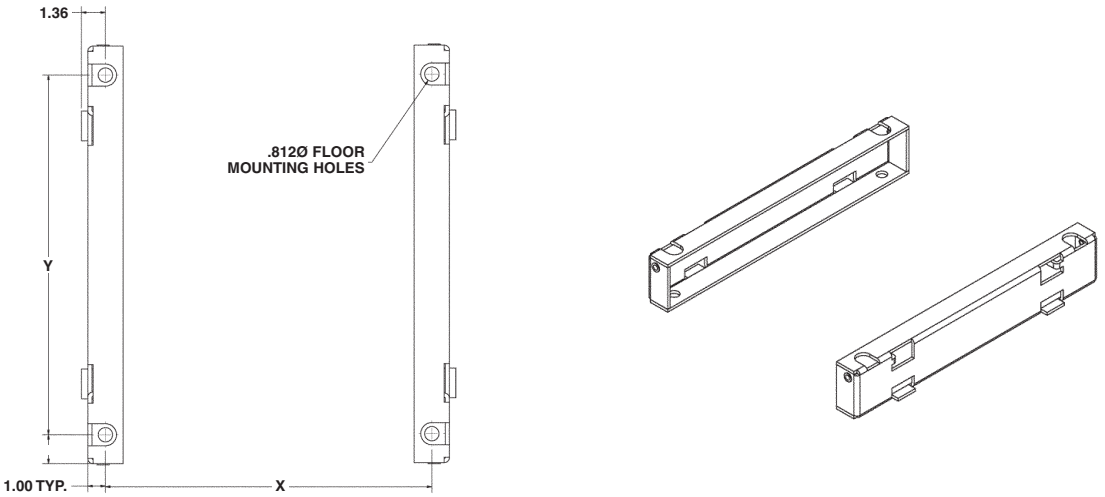


Fig. 3-5

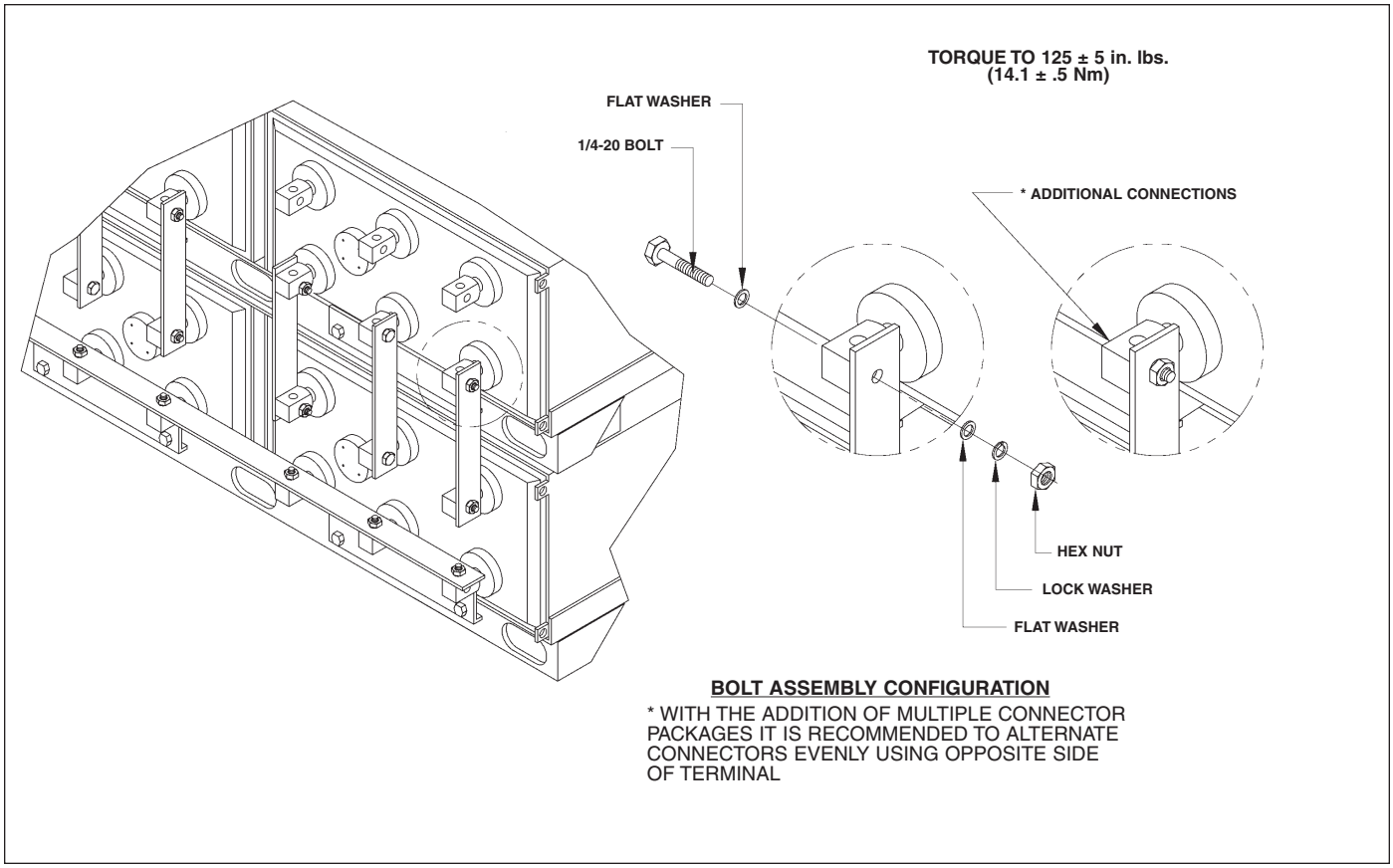


Fig. 4-1

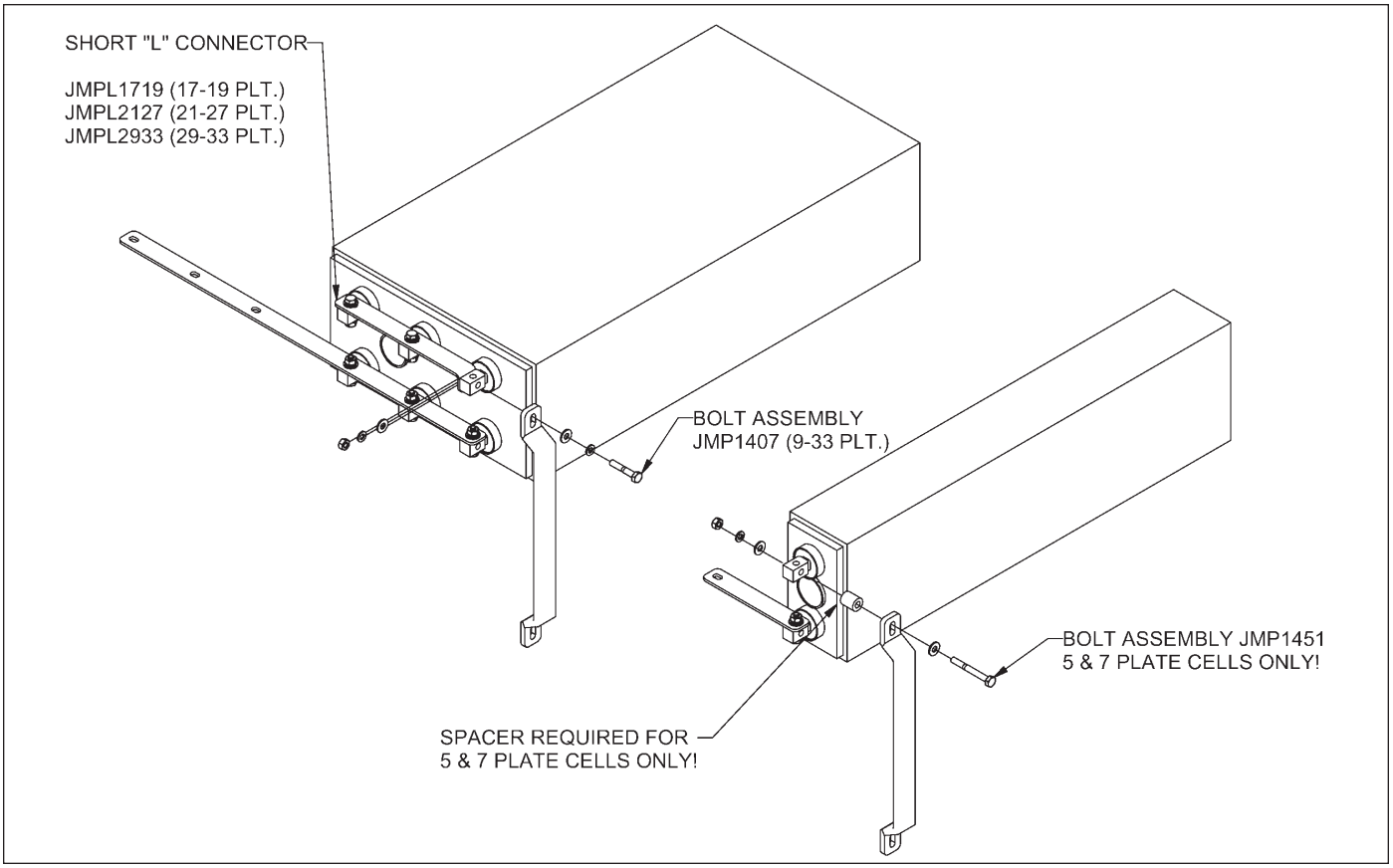

SHORT "L" CONNECTOR
JMPL1719 (17-19 PLT.)
JMPL2127 (21-27 PLT.)
JMPL2933 (29-33 PLT.)
BOLT ASSEMBLY
JMP1407 (9-33 PLT.)
BOLT ASSEMBLY JMP1451
5 & 7 PLATE CELLS ONLY!
SPACER REQUIRED FOR
5 & 7 PLATE CELLS ONLY!

Fig. 4-2

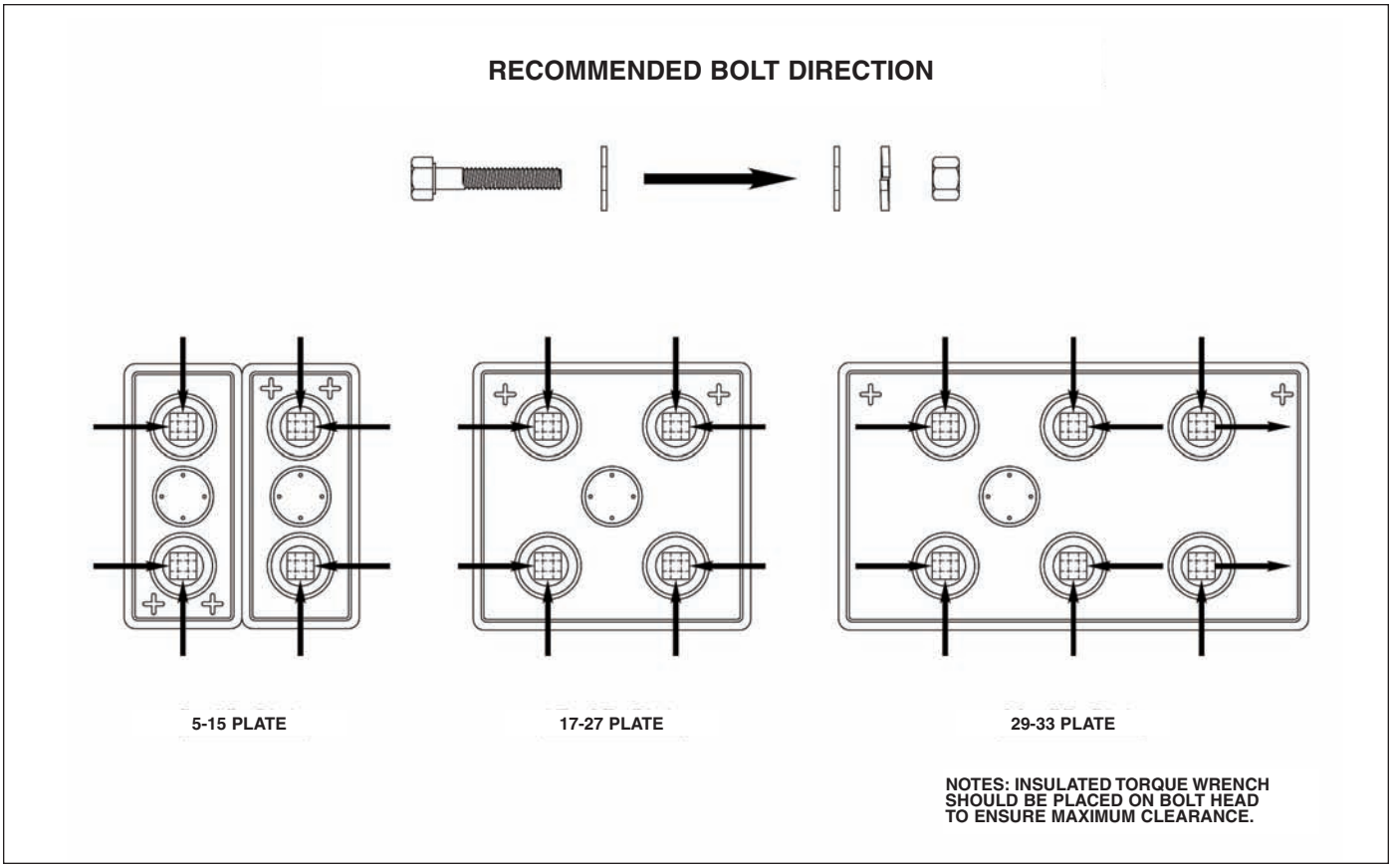

RECOMMENDED BOLT DIRECTION
5-15 PLATE
17-27 PLATE
29-33 PLATE
NOTES: INSULATED TORQUE WRENCH
SHOULD BE PLACED ON BOLT HEAD
TO ENSURE MAXIMUM CLEARANCE.

Fig. 4-3

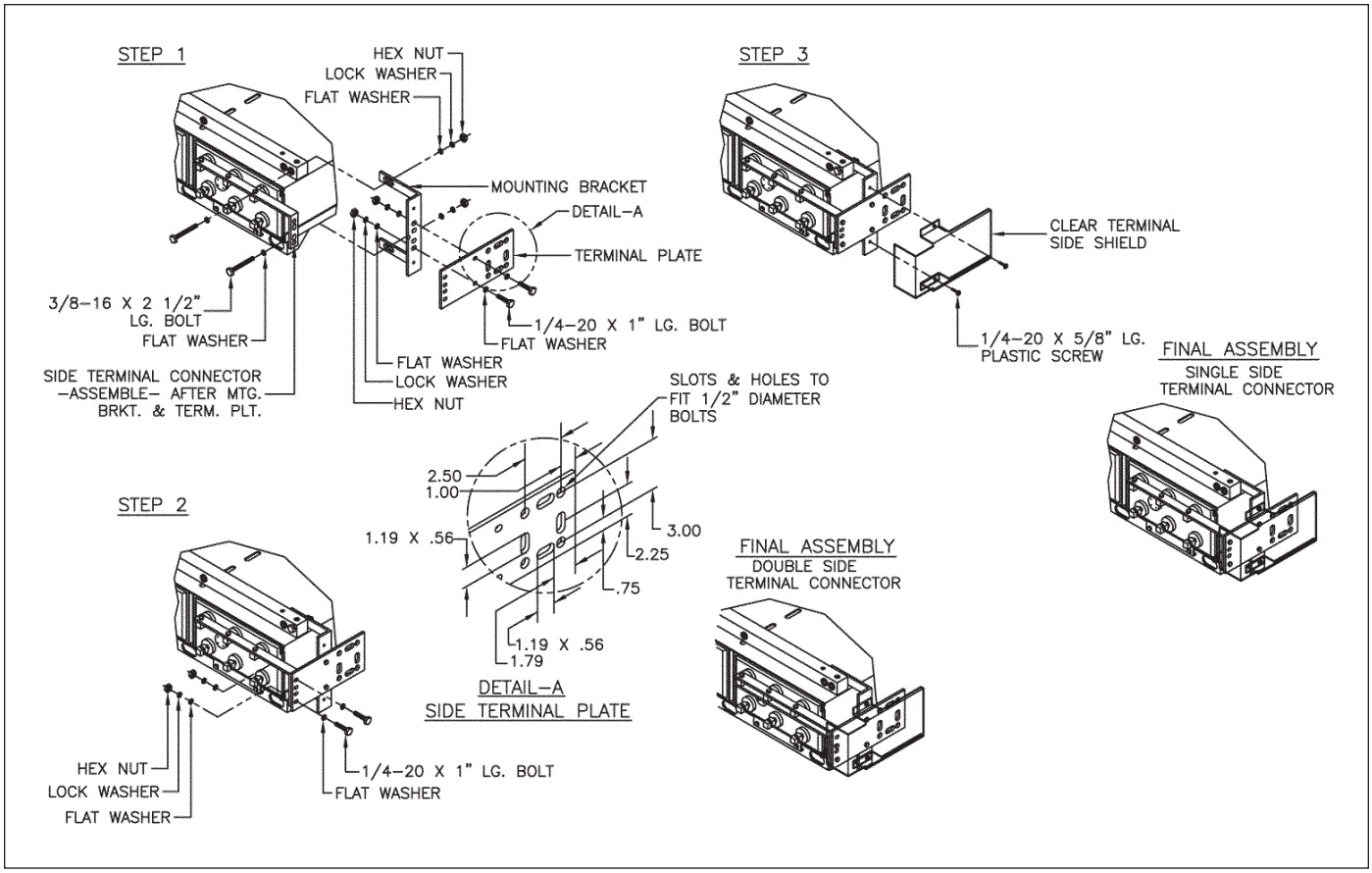


Fig. 5-1

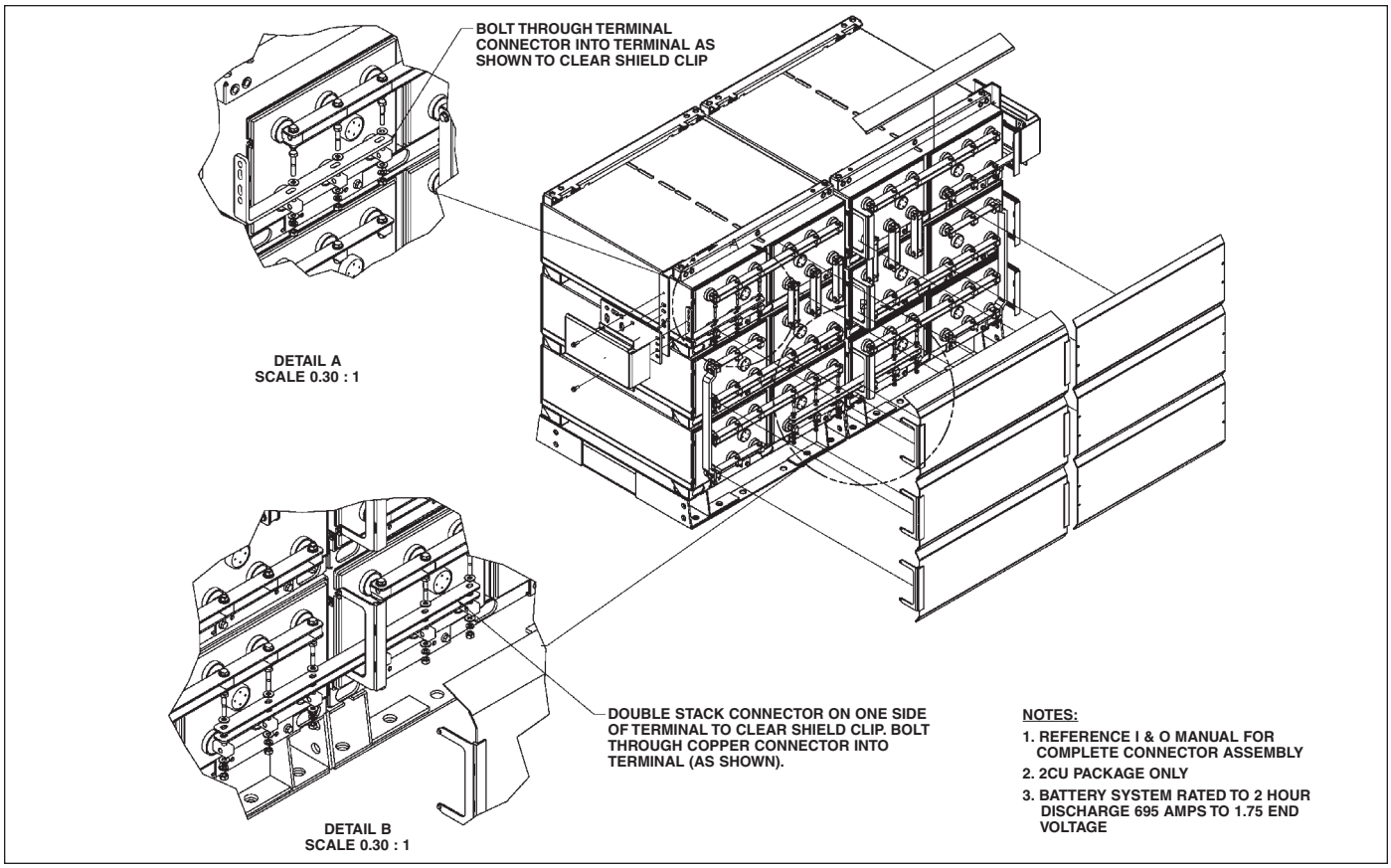


Fig. 5-1A

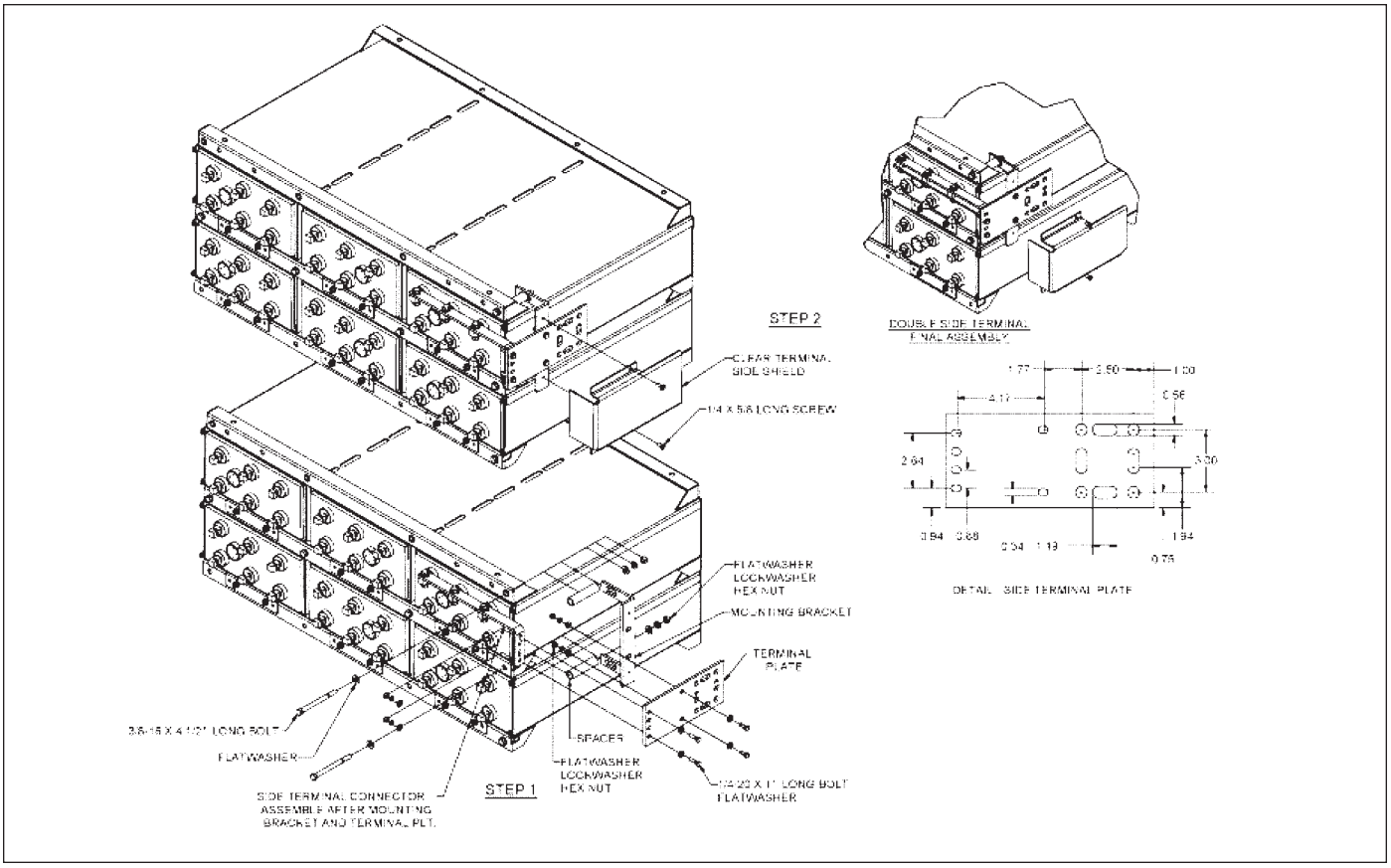


Fig. 5-2

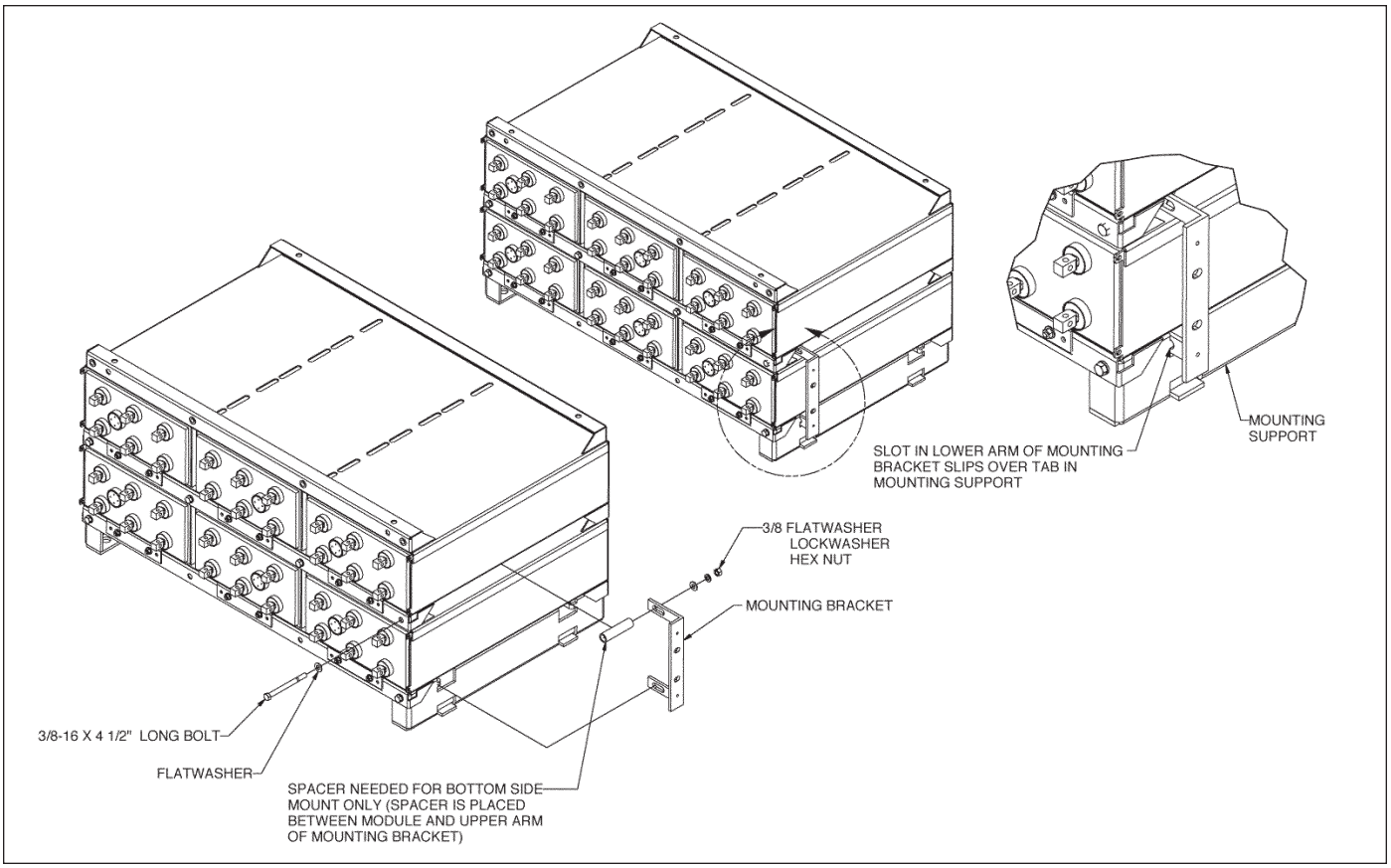


Fig. 5-2A

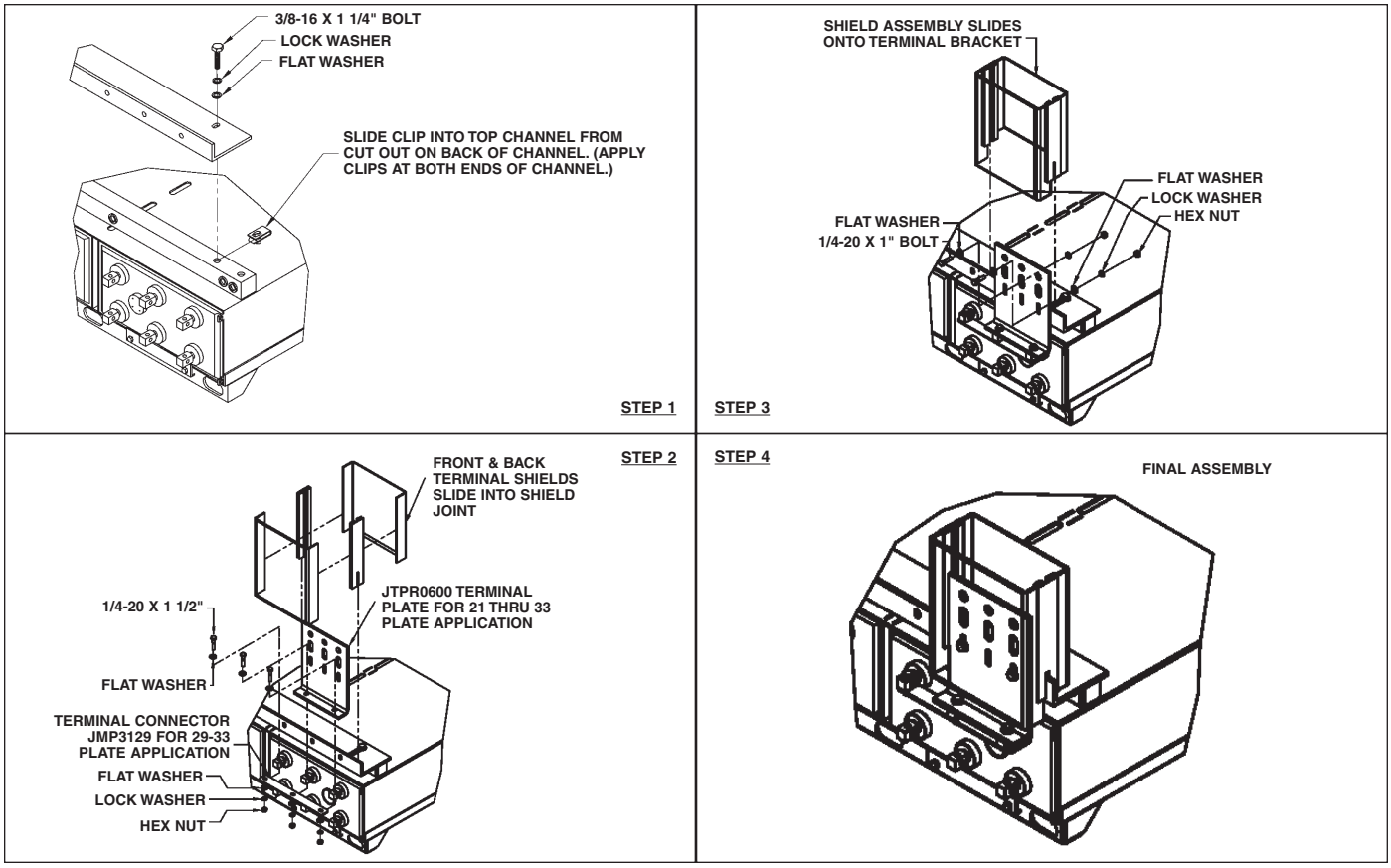


Fig. 5-3 (45, 75 & 95 AH)

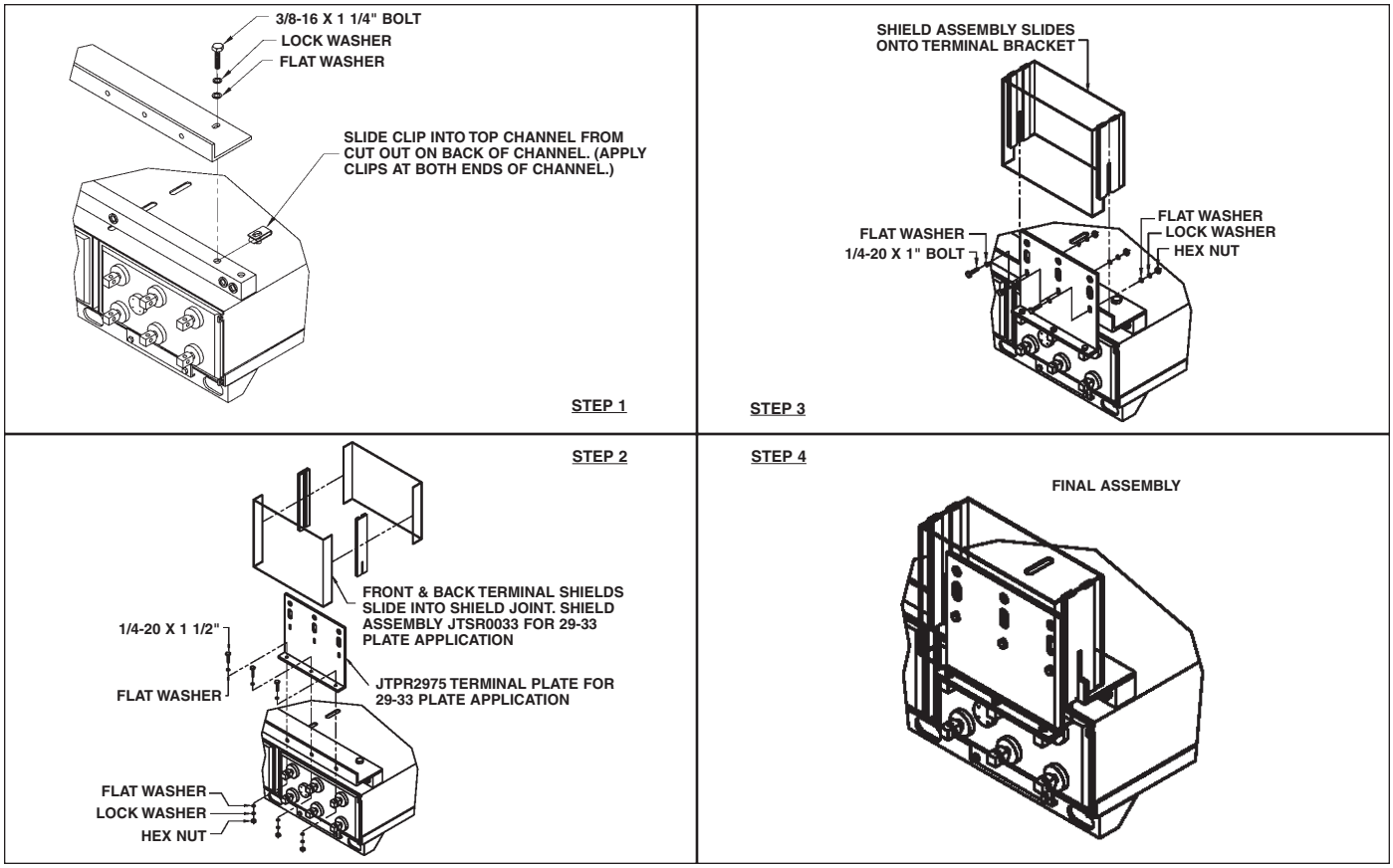


Fig. 5-3A (125 AH)

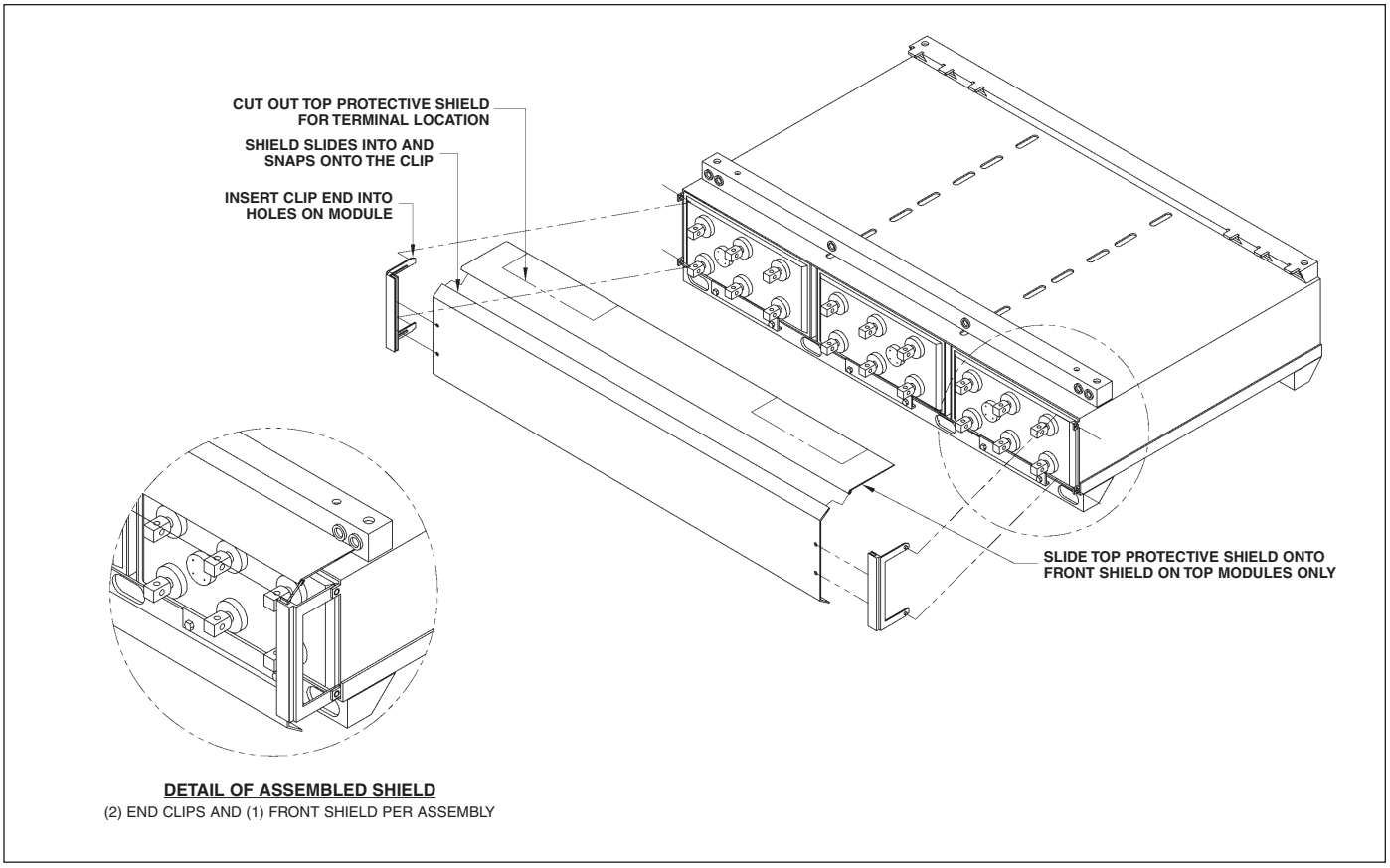

CUT OUT TOP PROTECTIVE SHIELD FOR TERMINAL LOCATION
SHIELD SLIDES INTO AND SNAPS ONTO THE CLIP
INSERT CLIP END INTO HOLES ON MODULE
SLIDE TOP PROTECTIVE SHIELD ONTO FRONT SHIELD ON TOP MODULES ONLY
DETAIL OF ASSEMBLED SHIELD
(2) END CLIPS AND (1) FRONT SHIELD PER ASSEMBLY

Fig. 5-4

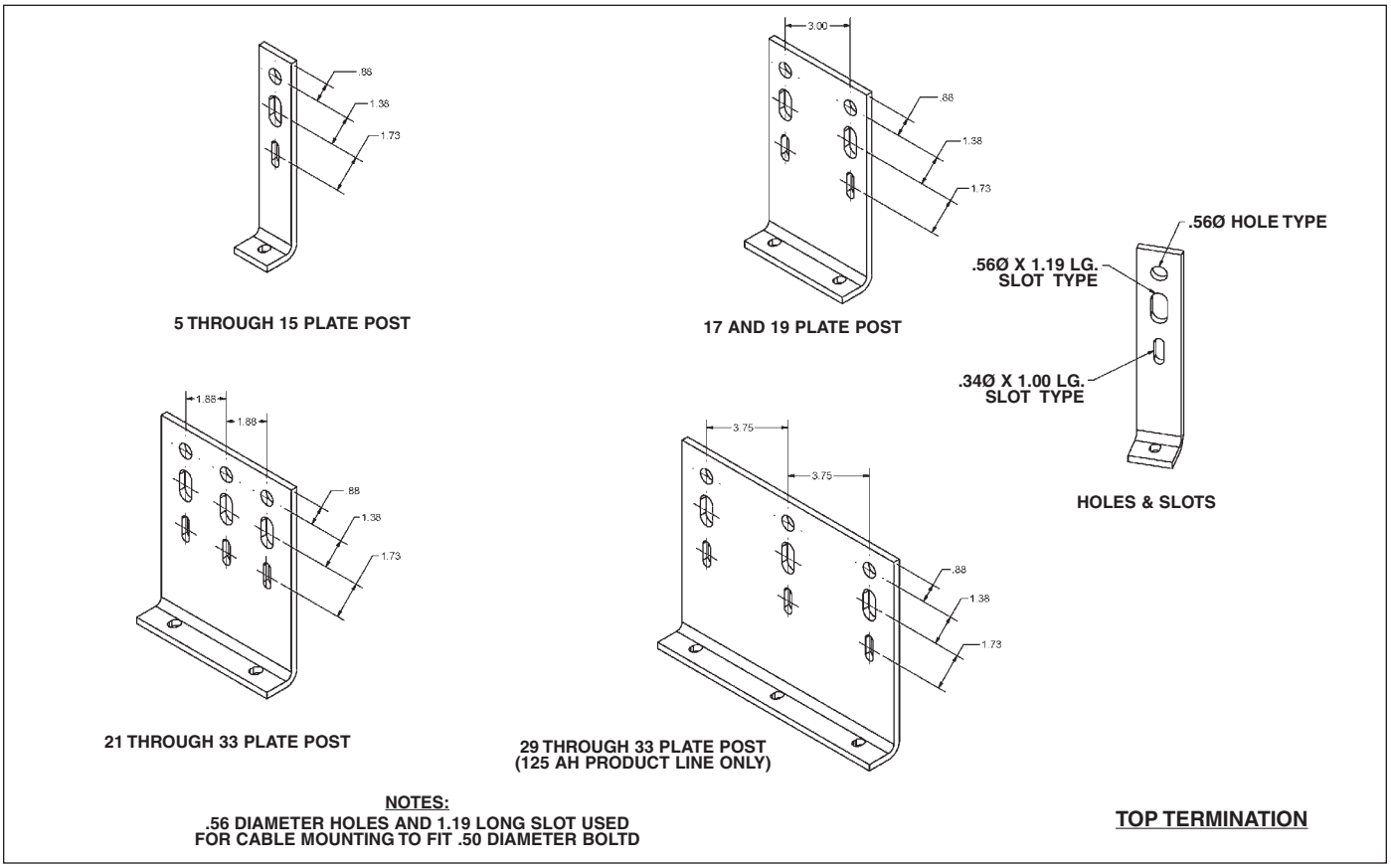

.88
1.38
1.73
5 THROUGH 15 PLATE POST
3.00
.88
1.38
1.73
17 AND 19 PLATE POST
.56Ø HOLE TYPE
.56Ø X 1.19 LG. SLOT TYPE
.34Ø X 1.00 LG. SLOT TYPE
HOLES & SLOTS
1.88
1.88
.88
1.38
1.73
21 THROUGH 33 PLATE POST
3.75
3.75
.88
1.38
1.73
29 THROUGH 33 PLATE POST (125 AH PRODUCT LINE ONLY)
NOTES:
.56 DIAMETER HOLES AND 1.19 LONG SLOT USED FOR CABLE MOUNTING TO FIT .50 DIAMETER BOLTD
TOP TERMINATION

Fig. 7-1

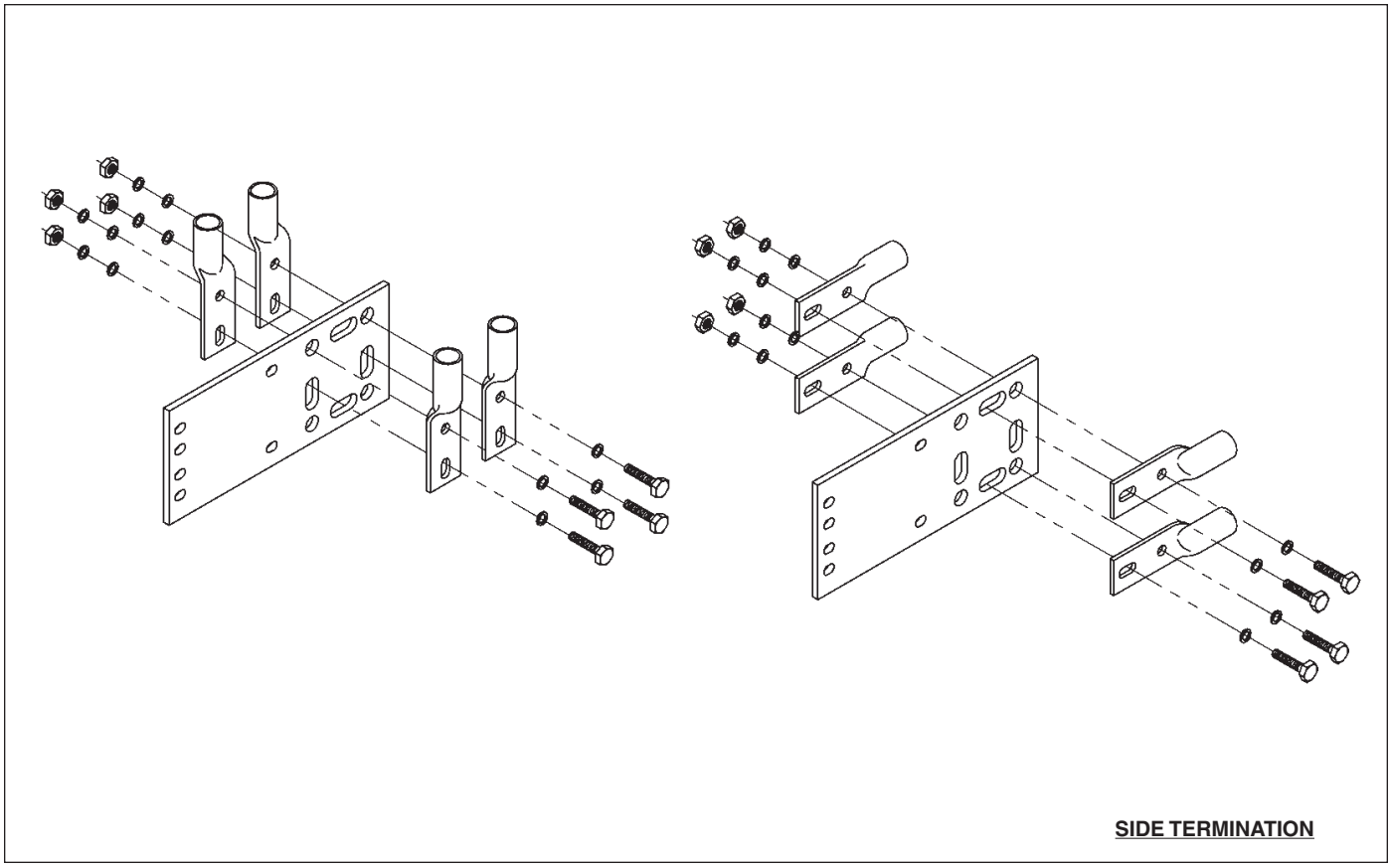


Fig. 7-1A

APPENDIX A

– Material Safety Data Sheet –
VALVE REGULATED LEAD-ACID BATTERY –
"BATTERY NON-SPILLABLE 49 CFR 173.159 (d)"

SECTION I

Manufacturer's Name: East Penn Manufacturing Co., Inc., Deka Road, Lyon Station, PA 19536

Telephone Number for Information: (610) 682-6361 **Date:** March 4, 2005

Emergency Telephone Number: CHEMTREC: 1-800-424-9300 **Trade Name:** Gel; Absorbed Electrolyte,
In Washington D.C. or outside continental U.S., call 1-202-483-7616 Sealed Valve Regulated Non-Spillable Battery

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	0.05mg/m^3	0.05 mg/m^3	60–75%	67%
Sulfuric Acid, CAS # 7664939	1.00 mg/m^3	1.00 mg/m^3	5–15%	10%
Antimony, CAS # 7440360	0.50 mg/m^3	0.50 mg/m^3	0–0.1%	<0.1%
Arsenic, CAS # 7440382	0.01 mg/m^3	0.01 mg/m^3	0.01%	<0.1%
Polypropylene, CAS # 9003070	N/A	N/A	2–10%	4%
Calcium, CAS # 7440702	1.0 mg/m^3	1.0 mg/m^3	0–0.1%	<0.1%
Tin, CAS # 7440315	2.0 mg/m^3	2.0 mg/m^3	0–0.1%	<0.1%

SECTION III
PHYSICAL/CHEMICAL CHARACTERISTICS

Electrolyte (Sulfuric Acid):

Appearance and Odor: Clear, odorless, colorless liquid
Boiling Point: 235–240°F
Evaporation Rate (Butyl Acetate=1): Less than 1.0
Melting Point: N/A
Solubility in Water: 100%
Specific Gravity (H_2O=1): 1.270–1.330
Vapor Density (Air=1): Greater than 1
Vapor Pressure (mm Hg): 10

SECTION IV
FIRE AND EXPLOSION HAZARD DATA

Flash Point (Method Used): Non-Flammable **Flammable Limits:** *Hydrogen Gas

Extinguishing Media: Class ABC extinguisher **LEL:** 4% **UEL:** 74%

NOTE: CO_2 may be used, but not directly on the cell. The thermal shock may cause cracking of the battery case and/or cases.

*** Hydrogen gas may be generated during battery charging.**

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.

continued

SECTION VI
HEALTH HAZARD DATA

Route(s) of Entry: Not applicable under normal use.

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 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: Avoid contact with absorbed electrolyte (sulfuric acid). May cause irritation of eyes, nose and throat. Contact with eyes and skin causes irritation and skin burns. Absorbed electrolyte is corrosive.

Medical Conditions Generally Aggravated by Exposure: Pregnant women and children must be protected from lead exposure.

Health Hazards (Acute and Chronic): Do not open battery, avoid contact with internal components. Internal components include lead and absorbed electrolyte. Electrolyte is corrosive and contact may cause skin irritation and chemical burns.

Emergency and First Aid Procedures (contact with electrolyte):

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: Electrolyte material is corrosive. Contains sulfuric acid. Neutralize any spilled material. Reference 1996 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: If battery case is broken, avoid direct contact with internal components. Keep away from ignition sources during charging.

SECTION VIII
CONTROL MEASURES

Respiratory Protection (Specific Type): N/A

Ventilation: Must be provided when charging in an enclosed area.

Protective Gloves: Recommended

Eye Protection: Recommended

Other Protective Clothing or Equipment: N/A

Work/Hygienic Practices: Good personal hygiene and work practices are recommended.

SECTION IX
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: The non-spillable lead-acid battery complies with the provisions listed in 49CFR173.159(d); therefore, must not be marked with an identification number, such as UN2800, or a hazard label, such as corrosive. Also, having passed IATA/ICAAO special provision A67, these batteries are not subject to the air dangerous goods regulations.

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) Batteries are subject to EPCRA reporting requirements under sections 302/304, 311/312, and 313.
Reporting quantities are as follows: Lead: section 311/312 = 10,000 lbs. Title III section 313 = 100 lbs.
Sulfuric Acid: section 311/312 = 500 lbs. Title III section 313 = 500 lbs.

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.**

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

– 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

Date: March 16, 2005

Emergency Telephone Number: CHEMTREC: 1-800-424-9300
In Washington D.C. or outside continental U.S., call 1-202-483-7616

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	0.05mg/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	<0.01%	——
Polypropylene, CAS # 9003070	N/A	N/A	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_2O=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.

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

continued

SECTION VI
HEALTH HAZARD DATA *(continued)*

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 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 IX
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 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.**

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 C

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.

APPENDIX D

Unigy II SPACESAVER® System Acid Volumes & Weights

Cell Size	Acid Wt gm	Acid Vol cc	Acid Vol gal	Acid Wt lbs	Pure Acid lbs
45-5	1,814	1,395	0.37	4.00	1.60
45-7	2,542	1,955	0.52	5.60	2.24
45-9	3,276	2,520	0.67	7.22	2.89
45-11	4,004	3,080	0.81	8.83	3.53
45-13	4,732	3,640	0.96	10.43	4.17
45-15	5,460	4,200	1.11	12.04	4.81
75-5	2,984	2,295	0.61	6.58	2.63
75-7	4,258	3,275	0.86	9.39	3.75
75-9	5,480	4,215	1.11	12.08	4.83
75-11	6,695	5,150	1.36	14.76	5.90
75-13	7,911	6,085	1.61	17.44	6.97
75-15	9,133	7,025	1.86	20.13	8.05
75-17	10,348	7,960	2.10	22.81	9.12
75-19	11,375	8,750	2.31	25.08	10.02
75-21	12,786	9,835	2.60	28.19	11.27
75-23	14,001	10,770	2.84	30.87	12.34
75-25	15,223	11,710	3.09	33.56	13.42
75-27	16,436	12,643	3.34	36.23	14.48
75-29	17,654	13,580	3.59	38.92	15.56
75-31	18,870	14,515	3.83	41.60	16.63
75-33	20,092	15,455	4.08	44.29	17.71
95-7	4,780	3,635	0.96	10.54	4.41
95-9	6,080	4,624	1.22	13.40	5.60
95-11	7,440	5,658	1.49	16.40	6.86
95-13	8,780	6,677	1.76	19.36	8.09
95-15	10,170	7,734	2.04	22.42	9.38
95-17	11,467	8,720	2.30	25.28	10.57
95-19	12,330	9,376	2.48	27.18	11.37
95-21	14,380	10,935	2.89	31.70	13.26
95-23	15,350	11,673	3.08	33.84	14.15
95-25	16,889	12,843	3.39	37.23	15.57
95-27	18,360	13,962	3.69	40.48	16.93
95-29	19,580	14,890	3.93	43.17	18.05
95-31	20,990	15,962	4.22	46.28	19.35
95-33	22,410	17,042	4.50	49.41	20.66
125-33	33,531	25,793	6.81	73.92	30.90
125LG-33	33,531	26,681	6.81	58.82	20.23

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

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EAST PENN manufacturing co., inc.

Lyon Station, PA 19536-0147 • Phone: 610-682-6361 • Fax: 610-682-4781

Order Department Hotline: 610-682-4231

www.eastpennunigy.com • E-mail: sales@eastpennunigy.com

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