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Lead-Acid Industrial Storage Batteries For Stationary Service

NEMA

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION ■ 2101 L STREET, N.W. WASHINGTON, D.C. 20037

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Foreword

These standards have been developed by the Industrial Battery and Charger Section of NEMA which periodically reviews them for any revisions necessary to keep them up-to-date with advancing technology. Comments or recommended revisions are welcome and should be submitted to:

Manager, Engineering Department
National Electrical Manufacturers Association
2101 L Street, N.W., Suite 300
Washington, D.C. 20037

Scope

This standards publication covers safety recommendations and requirements for lead-acid industrial storage batteries used as a source of standby power for switchgear, control, communications, uninterrupted power and emergency lighting systems.

Purpose

The purpose of this standards publication is to provide practical information on the safe installation, maintenance and use of lead-acid industrial storage batteries for stationary service.

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Lead-Acid Industrial Storage Batteries For Stationary Service

Part 1

DEFINITIONS

1. The terms used in this publication are defined in accordance with NEMA Standards Publication *Definitions for Lead-Acid Industrial Storage Batteries,* IB 1-1971 (R 1976), if applicable.

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Part 2

INTRODUCTION

1. Before proceeding with the unpacking, handling, installation and operation of a lead-acid industrial storage battery, the following instructions should be read and understood:

a. the manufacturer's and supplier's installation and operation procedures, or both.

b. the manufacturer's and supplier's maintenance procedures, or both.

c. the safety precautions referenced in this document.

2. Only trained personnel who are totally familiar with and understand the above documents should be permitted to install, operate, and maintain lead-acid stationary batteries.

3. A lead-acid battery is an electro-chemical device containing an electrolyte which is a dilute solution of sulfuric acid and water. This electrolyte is corrosive and may cause burns.

4. Lead-acid battery systems, when installed, may have high voltages above (600 volts) which can cause electrical shocks to personnel.

5. All lead-acid batteries, in the course of normal operation, generate hydrogen and oxygen gases which are explosive if ignited.

6. If the following precautions are not fully understood, clarification should be obtained from the battery manufacturer or supplier. Local conditions may introduce situations not covered by these safety precautions. The battery manufacturer or supplier should be contacted for guidance with a particular safety problem.

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Part 3

GENERAL SAFETY PRECAUTIONS

1. Nonporous acid resistant apron, gloves, boots, and safety goggles (or face shield) should be worn when handling and installing batteries. This will help prevent injury due to splashing or spillage of electrolyte.

2. Smoking should be prohibited. Flames and sparks of all kinds should be kept away from the vicinity of storage batteries. Liberated or entrapped hydrogen gas in the cells can be ignited, causing an explosion and injury to personnel.

3. Watches or metallic jewelry should not be worn when working on batteries. Tools or instruments should never be placed on top of cells. Insulated metal tools and test prod handles should be used. These items can come in contact with the cell terminals which can result in a shock hazard or cause severe burns from high currents. Such contact can also generate sparks which can ignite the hydrogen gases in the cells, causing an explosion.

4. When preparing electrolyte, **ACID SHOULD ALWAYS BE POURED INTO WATER; WATER SHOULD NEVER BE POURED INTO ACID.** Failure to follow this precaution may result in excess heat and violent chemical reaction which may cause severe burns. Acid should always be mixed in a well-ventilated area.

5. If electrolyte comes into contact with skin or clothing, it should be washed immediately with water. If electrolyte comes into contact with the eyes, any contact lenses should be removed, and the eyes should be flushed immediately and thoroughly with water. Medical attention should be obtained immediately when eyes are affected.

6. Care should be exercised when handling cells. Lifting straps and strap spreaders are recommended and should be used with appropriate mechanical equipment to handle cells safely and to avoid injury.

7. Any electrolyte spilled when handling or installing cells should be promptly neutralized and removed. A sodium bicarbonate ($NaHCO_3$) / water solution (1 lb. of $NaHCO_3$ per gallon of water) should be used to neutralize the electrolyte and prevent possible injury. Electrolyte is neutralized when addition of the $NaHCO_3$ solution does not bubble.

8. All battery connections should be properly prepared and tightened to prevent possible injury or failure of the system. The manufacturer's published instructions should be referenced when making connections.

9. Access to battery areas should be restricted to trained, authorized personnel only.

10. Precautions should be taken against static sparks while working on the battery. This precaution should be observed even when working on cells with flame arrestor vents because of the remote possibility of cell cover seal leaks, post seal leaks, or seal leaks between the flame arrestor vents and battery cover. To discharge static electricity from your body, touch any ground well away from the top of the cells. The wearing of leather-soled shoes is recommended where static electricity is a problem. A cotton cloth, rather than a cloth made from synthetic materials, should always be used when cleaning the battery.

11. Although it is possible to operate a battery installation safely without grounding the battery rack by always ensuring the batteries are free from moisture or dirt, it is strongly recommended that all battery racks be grounded to the station grounding system.

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Part 4

BATTERY LOCATION

1. It is recommended that the battery be installed in a clean, cool, (21 °C to 27 °C) (70 °F to 80 °F) dry location. Cells should not be exposed to heating units, strip heaters, radiators, steam pipe, or direct sunlight.

2. Natural ventilation may be sufficient to many battery installations. However, forced ventilation may be required in some battery rooms to prevent hydrogen, liberated from the cells in service, from exceeding a 1 percent by volume concentration, an OSHA requirement.

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Part 5

BATTERY SHIPMENT

1. Most cells are packed in individual, corrugated cartons. Some small cells are packed in a master carton containing two or more cells. Cells packed in cartons are usually shipped on pallets. To prevent injury when removing material holding the cartons to pallets, care should be exercised when cutting the banding material. If individual cells are to be moved to another location, the carton should not be removed at this time. Caution should be exercised to prevent spillage of electrolyte. The cell should not be tilted more than 25 degrees from vertical. When cells have been brought to the installation site, the carton sleeve and top corrugated spacers should be removed. See Figure 5-1. Battery cartons or packing materials on which battery acid may have spilled can cause injury when handled. Such items should be handled with great caution.

2. The cell containers should be inspected for cracks before they are removed from the pallets. If any sign of damage is visible, no attempt should be made to remove the battery from the pallet. Supervisory personnel should be notified.

3. A non-conductive lifting strap and a strap spreader are recommended for use with mechanical lifting devices when cells are too heavy to be handled by personnel. See Figure 5-2 for typical positioning of strap and spreader. Lifting straps and spreaders, when provided with suitable mechanical lifting devices, should always be used to prevent injury. Reference should be made to the manufacturer's or supplier's published instruction on handling procedure.

4. A battery should never be lifted by its cell or unit terminal posts.

5. Cells should never be slid across rough surfaces because severely scratching the plastic container bottom may result in stressing and rupturing the container and subsequently spilling electrolyte. Care should always be exercised when handling cells to prevent scratching the plastic containers and covers.

6. Occasionally, flexible plastic dust caps or screw-type shipping vent caps are installed on batteries. Before disposing of these items any electrolyte on them should be neutralized with sodium bicarbonate ($NaHCO_3$) water solution (1 lb. of $NaHCO_3$ per gallon of water) to prevent injury.

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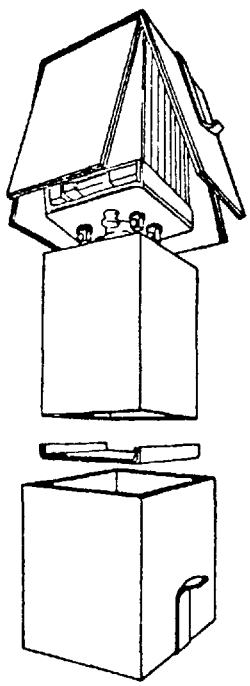


Figure 5-1
TYPICAL CELL PACKAGING

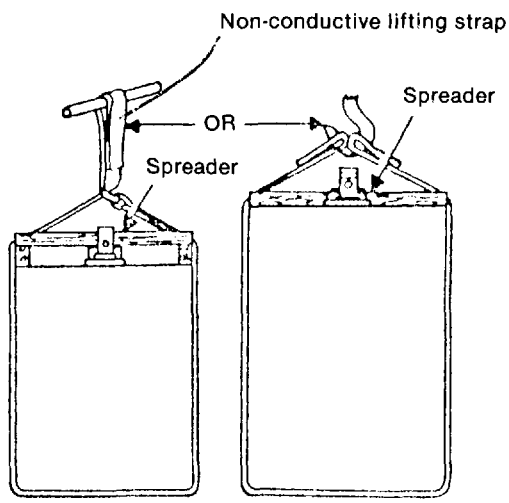


Figure 5-2
TYPICAL STRAP AND SPREADER POSITION

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Part 6

BATTERY AND RACK ASSEMBLY

1. The manufacturer's or supplier's published instructions and applicable drawings for construction of battery rack and cell assembly should be referenced.

2. For stability and safety when installing cells on the rack, one should start in the center of the lower step or tier.

3. Adjacent cells should not touch; nor should any cell contact noninsulated metal rack supports or metal cable conduits. Proper alignment and spacing between cells or multicell units should be checked. This is a precautionary measure to prevent leakage currents between cells caused by dust and moisture that may accumulate on the cells. This should be completed before installation of intercell connectors.

4. As a precautionary measure to prevent igniting explosive gases internal to the cell, flame arrestor vents should be secured in position immediately after the cell has been placed on the battery rack.

5. The manufacturer's or published instructions should be referenced when installing intercell and battery connections. These instructions should define the torque required if bolted connections are furnished. Precautions should be taken to assure connections remain tight. Loose connections may cause overheating and sparks.

6. If electrolyte is lost through spillage and it should become necessary to mix electrolyte, extreme caution should be used. See Part 2, paragraph 4, for mixing electrolytes.

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Part 7

BATTERY MAINTENANCE PRECAUTIONS

1. General maintenance should never be performed on a battery that is on equalizing charge. However, taking voltage, temperature, and specific gravity readings on cells is permissible during equalizing charges if the precautions referenced in this document are followed. An equalizing battery will generate increased amounts of explosive gases which increases the explosive hazard. General maintenance should be performed when the battery is floating at its normal rate.

2. Cell containers and covers should be periodically cleaned with a water dampened cotton cloth to remove accumulated dust. Gases carry small amounts of electrolyte that eventually deposit on the cell parts. Electrolyte is an excellent electrical conductor which can develop small ground shorts between cells.

3. The cells or unit exterior surfaces should be neutralized with a sodium bicarbonate ($NaHCO_3$) water solution (1 lb. of $NaHCO_3$ per gallon of water) which should be applied with a cloth dampened with the solution, ensuring that none enters the cell. Neutralization should be continued until the fizzing action ceases. Then the area should be wiped with a water-dampened cloth to remove the soda solution and wiped dry with a clean cotton cloth. Such cleaning precautions should minimize the development of leakage current between cells. Plastic cell containers and covers should never be cleaned with anything but water or baking soda.

4. Water should be added periodically. The water vessel used should be non-metallic to prevent accidental shorting of battery terminals. The electrolyte level should always be maintained between the high and low level lines on the cell. If the electrolyte falls below the low level line, it may eliminate the features of the flame arrestor vent.

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(Bylaw—Art. V, Sec. 1)

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A standard of the National Electrical Manufacturers Association defines a product, process or procedure with reference to one or more of the following: nomenclature, composition, construction, dimensions, tolerances, safety, operating characteristics, performance, rating, testing, and the service for which they are designed.

(Bylaw—Art. V, Sec. 2, Subsection A)

Dimensions

Where dimensions are given for interchangeability purposes, alternate dimensions satisfying the other provisions of the standards publication may be capable of otherwise equivalent performance.

(NEMA Policy Memorandum 84-2, dated June 7, 1984)

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(Bylaw—Art. V, Sec. 2, Subsection B)

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(Bylaw—Art. V, Sec. 6, 1st Sentence)

Official Standards Proposal

An Official Standards Proposal is an official draft of a proposed standard which is formally recommended to an outside organization(s) for consideration, comment and/or approval.

(Bylaw—Art. V, Sec. 4, Subsection A)

Identification of Status

Standards in NEMA Standards Publications are identified in the foreword or following each standard as "NEMA Standard" or "Suggested Standard for Future Design." These indicate the status of the standard. These words are followed by a date which indicates when the standard was adopted in its present form by the Association.

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INDUSTRIAL BATTERY AND CHARGER SECTION
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MEMBER COMPANIES

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Toledo, OH 43608

C & D Batteries Division
An Eltra Company
Plymouth Meeting, PA 19462

Chloride Industrial Batteries
A Division of Chloride Incorporated
Kansas City, KS 66115

Douglas Battery Manufacturing Company
Winston-Salem, NC 27107

East Penn Manufacturing Company, Inc.
Lyon Station, PA 19562

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Horsham, PA 19044

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