INSTALLATION, OPERATION AND MAINTENANCE MANUAL

– IMPORTANT – READ SAFETY INFORMATION FIRST –

MSE VALVE REGULATED LEAD ACID BATTERIES TABLE OF CONTENTS

NOTICE TO READERS - THIS MANUAL IS FOR REFERENCE ONLY

These instructions do not claim to cover all details or variations in the equipment, procedure, or process described, nor to provide directions for meeting every possible contingency during installation, operation, or maintenance. When additional information is desired to satisfy a problem not covered sufficiently for the user's purpose, please contact your Panasonic Industrial Company, Battery Sales Group, Account Manager.

It is the responsibility of each user to ensure that each battery application system is adequately designed safe and compatible with all conditions encountered during use and in conformance with existing codes, standards and requirements. Any circuits contained herein are illustrative only and each user must ensure that each circuit is safe and otherwise completely appropriate for the desired application. This literature contains information concerning cells and batteries manufactured by Matsushita Battery Industrial Co., Ltd. This information is generally descriptive only and is not intended to make or imply any representation guarantee or warranty with respect to any cells and batteries. Cell and battery designs are subject to modification without notice. No liability is assumed as a result of their use or application. All descriptions and warranties are solely as contained in formal offers to sell or quotations made by Matsushita Battery Industrial Co., Ltd., Panasonic Sales Companies and Panasonic Agencies.

Thank you for choosing Panasonic.
Help us help you....

1.0 General Information

Read this manual carefully. It is intended to help you operate and maintain your new Panasonic MSE Valve Regulated Lead-Acid battery properly and safely.

SAVE THESE INSTRUCTIONS

This manual provides information regarding battery room design, battery installation, operation, maintenance, storage and safety. **Failure to follow the precautions in this manual may result in damage of equipment and/or injury or loss of life.** Keep this manual handy for answers to your questions.

1.1 Getting Help

We welcome your suggestions on how we can improve our products and want to hear from you about any problems you might experience.

If you do not understand something or need more help, you can contact us by e-mail at: msebatt@panasonic.com, or call our toll-free phone number within the Continental U.S.A.: **(800-793-3772)**.Also, visit our website for literature/manual information: www.panasonic.com/batteries and look under VRLA Stationary batteries.

1.2 Getting Help Outside the USA

Contact information, phone and fax numbers, for Panasonic sales offices outside the United States are located on the back cover of this manual.

1.3 MSE Battery Product and Warranty Registration

Locate the MSE battery product and warranty registration document/self-mailer that is provided in a brown envelope with this manual.
The warranty registration document is a multi-part form where the factory has recorded each MSE cell serial number. Fill out the end-user requested information, keep the top (white) copy for your records, fold and seal per directions and drop in the mail. The postage is pre-paid for mailings in the United States. Complete and mail the User Product/ Warranty Registration form so that we may contact you directly for technical support and other product information.

Each Panasonic MSE battery is sold subject to a limited warranty, which is in place of all other warranties, express or implied and which limits the purchaser/user remedy to the repair or replacement of a defective battery or parts thereof.

1.4 MSE Battery Warranty Notice

Limited Product Warranty Summary
• The terms of the warranty are available upon written request to Panasonic Industrial Company, North American Sales or contact your Account Manager.
• Save proof of original purchase date to establish warranty period.

WHAT IS COVERED
• From date of original delivery, we will provide, free of charge, parts to repair or replace your battery if it fails because of a manufacturing defect. **See terms for details.**
• This warranty is extended to the original purchaser for products purchased in the U.S.A. and Canada.
• All warranty service will be provided by our Factory Service Center or authorized service personnel.

WHAT IS NOT COVERED
• Service trips to your location to teach you how to use the product.
• Failure of the product if it is used for other than its intended purpose.
• Damage to product caused by accident, fire, floods or acts of God.
• Damage to product caused by failure to follow manufacturer's installation, operation or maintenance instructions.

Read your Installation, Operation and Maintenance Manual. If you then have any questions about the installation and operation of the product, please contact Panasonic Industrial Company or your Account Manager.

1.5 Protect the Environment - Recycle

Federal and State regulations require that all lead-acid batteries be recycled. All Panasonic sealed lead acid batteries are covered by the Panasonic SAV-LEAD Recycling Program. For information on how to recycle your Panasonic batteries call toll-free: 1-800-SAV-LEAD (1-800-728-5323).

1.6 MSE Valve Regulated Lead-Acid Battery Application Notes

The Panasonic batteries described in this Installation, Operation and Maintenance Manual are valve-regulated lead-acid (VRLA) MSE batteries.

This battery is designed for industrial use **ONLY** in stationary standby (emergency) battery power applications and is **NOT** intended for application in vehicle starting, lighting, and ignition (SLI), electric vehicles (EV) of any design and/or operation with any

tools or power appliances. Use these batteries **ONLY** for their intended purpose as described in this manual.

The MSE product warranty is VOID if cells/ battery are used for any other application than described in this manual.

CAUTION: Use of these batteries other than in accordance with the manufacturer's written instructions may produce hazardous and unsafe operating conditions that may cause damage to equipment and/or personal injury.

1.7 MSE General Product Description

MSE batteries are valve regulated non-spillable lead-acid batteries with pasted lead-calcium plates. VRLA batteries differ substantially from conventional vented (flooded batteries) in design, operation, and more importantly, in potential hazard.

Electrolyte

The electrolyte in the MSE battery is held captive in an Absorbent Glass Mat (AGM) separator located between the plates that immobilizes the electrolyte in the cell. AGM separator material is a highly porous, absorbent micro fiberglass mat mixed with polymer fibers that immobilizes the electrolyte and creates a situation where a spill of electrolyte is highly unlikely. There is NO "free" electrolyte to leak out if the cell is tipped over (cell case and cover are sealed together) or if the cell is punctured. Typical accidents where a VRLA battery case is punctured result in a slight drip or a slow ooze of liquid material out of the cell that cannot be characterized as a spill.

VRLA batteries also differ from conventional vented (flooded cells) because they contain only a minimum amount of electrolyte. The large size MSE cell, MSE-1440, contains only 4.07 gallons of 1.310 specific gravity electrolyte. Of those 4.07 gallons of electrolyte, only 1.209 gallons is 100% sulfuric acid. EPCRA reporting requires that only the amount (pounds) of 100% sulfuric acid is reportable. VRLA battery electrolyte is a dilute mixture of sulfuric acid in water, which typically has a specific gravity between 1.270 and 1.300. Specific Gravity (Sp.Gr.) is a measure of the density of a liquid as compared to that of water, which has a Sp.Gr. of 1.000. Pure sulfuric acid has a specific gravity of 1.835.

NOTE: Panasonic MSE VRLA batteries do NOT contain a gel electrolyte.

VRLA cells are classified as non-spillable and non-hazardous by the US Department of Transportation [meet the requirements of 49 CFR 173, 159 (d)-see MSE Safety Data Sheet (MSDS) on page 18 of this manual]. These batteries are classified as Non-Hazardous Articles for domestic trucking, domestic/ international airfreight and ocean freight shipment.

During normal battery installation, operation and maintenance, the user has NO contact with the internal components of the battery or its internal hazardous chemicals.

1.8 Ventilation

General room ventilation, other than required by local building codes, is sufficient during normal battery operation. Two to three room air changes per hour are recommended to prevent a possible buildup of hydrogen gas.

Charge batteries only in accordance with the instructions in this manual.

1.9 Product Shipping Notes

MSE 150, 200, 300 and 500 cells are shipped in a box separate from the modules and are installed into the modules at the site.

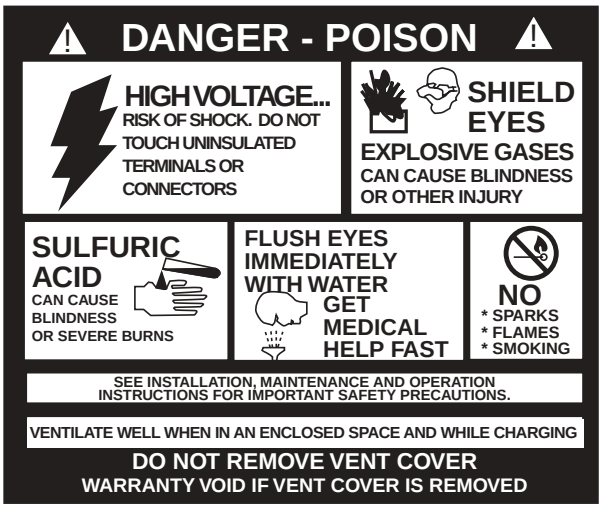
MSE 960 through 1440 cells are shipped in pre-assembled modules for quick and easy installation.

MSE batteries are designed to provide reliable service life in DC back-up power applications with minimal maintenance.

2.0 Important Safety Instructions

Read and understand all instructions before using this equipment.

Valve Regulated Lead-Acid (VRLA) batteries are potentially dangerous and proper precautions must be observed in handling and installation. Only authorized personnel who have been trained in handling battery installation, charging, operation and maintenance procedures should be permitted access to any battery system.



(Warning label found on MSE Batteries)

DANGER: To reduce the risk of fire, electric shock, or injury when using this equipment, follow basic precautions, including the following:

- Use this equipment only for its intended purpose as described in this Installation, Operation and Maintenance Manual.
- This equipment must be properly installed and located in accordance with the Installation Instructions before it is used.
- Properly ground equipment to conform to all governing codes and ordinances.
- Install or store where it will not be exposed to the weather or to temperatures below freezing.
- Connect to a properly rated, protected and sized power supply circuit to avoid electrical overload.
- Do not repair or replace any part of the battery or attempt any servicing unless specifically recommended in this manual or in published user-repair instructions that you understand and have the skills to carry out.

DANGER – EXPLOSIVE GASES

- HYDROGEN GAS is produced by the chemical action within the battery cells. These battery cells are valve regulated and under normal operating conditions, do not present any hydrogen gas danger. However, if the battery is overcharged or the safety vent is damaged and/or open, hydrogen gas can accumulate in the area of the battery location. HYDROGEN GAS CAN BE EXPLOSIVE UNDER THESE CIRCUMSTANCES. So to prevent the possibility of damage or injury, if you smell any gas, vent the immediate area. This will allow any hydrogen gas to escape. Since the gas is flammable, DO NOT smoke or use an open flame near the battery. Immediately call for service.
- VRLA batteries are sealed with the electrolyte immobilized within the cell. Under normal operating conditions, there is no acid danger. However, if the battery cell cover or case is damaged, acid could be present. SULFURIC ACID CAN BURN OR INJURE SKIN, EYES, AND PROPERTY.

IN THE EVENT OF CONTACT WITH SULFURIC ACID...

Wash skin with large amounts of clean water, then cover immediately with dry gauze and obtain immediate medical attention.

- For the eyes, wash out with large amounts of water and obtain immediate medical attention.

2.1 Protective Equipment

To assure protection of personnel and safe battery handling, the following equipment should always be available and used:

- Safety glasses with side shields, goggles, and/or face shields.
- Acid-resistant gloves
- Protective aprons and safety shoes.
- Portable or stationary water facilities for rinsing eyes and skin in case of contact with electrolyte.
- Baking soda mixed approximately 1 lb. to 1 gal of water to neutralize electrolyte spillage or acid spill clean-up kit.
- Adequately insulated tools.
- Lifting devices of adequate capacity.
- Class C fire extinguisher.

2.2 Safety Precautions

Observe the following procedures when working with battery systems:

- **DO** use caution when working on batteries as they present a shock hazard.
- **DO** remove all jewelry, rings, watches and any other metallic objects while working on batteries.
- **DO** wear safety glasses or face shield and safety shoes and gloves when working on or near battery.
- **DO** use tools with insulated handles.
- **DO** remember that battery electrolyte can harm skin and eyes.
- **DO** make sure that all connections to the load or test equipment include short-circuit protection.
- **DO** make sure the battery area is ventilated.

- **DO NOT** smoke or introduce open flames or arcing in the immediate vicinity of the battery.
- **DO NOT** allow metal tools or other metal parts to rest on battery or fall across terminals.
- **DO NOT** wear nylon coats or overalls as they can create static electricity.
- **DO NOT** tamper with or remove the pressure relief valves.
- **DO NOT** install battery in a non-ventilated room.

For more information on safety precautions, see the MSE Material Safety Data Sheet (MSDS) on page 18 of this manual.

2.3 National/Local Electrical Code Requirements

This Installation manual assumes that personnel authorized to install and maintain DC battery power systems are qualified to work with the systems and have a demonstrated level of competence and experience with the systems and are also familiar with the governing Federal, National, and Local bodies and industry groups that regulate the safety, installation design, battery installation, testing, operation, and maintenance of valve-regulated (sealed) lead-acid batteries for stationary applications.

Here is a recommended list of codes, practices and procedures that are applicable to valve-regulated, lead-acid batteries that should be consulted regarding the safety, handling, installation, testing and maintenance of stationary batteries. **Note**: State and Local codes **also** must be followed. This information does not claim to cover all the details in regulations, practices and codes for stationary battery installation. This information is **NOT** a full listing of all the codes and is **NOT** a substitute for the end-user to locate and determine which codes and practices apply to their particular sites. This information is based on Codes, Practices and Procedures that were in effect as of April 1, 2001. As these do change, always be sure that you are following the most current information.

Code of Federal Regulations (CFR)

The Code of Federal Regulations (CFR) is a collection of regulations that have been proclaimed under U. S. law. Under the

CFR, the Occupational Safety and Health Administration, Department of Labor, is designated under the OSHA Act to provide "so far as possible, every working person in the nation safe and healthful working conditions." Title 29-Labor, Chapter XVII, CFR Part 1926, is the safety and health regulations for construction. Each part is segmented into subparts.

29 CFR 1926.441 – Batteries and Battery charging; Requirements for unsealed batteries. **Note**: Panasonic MSE batteries are the valve regulated type, thus 29 CFR 1926.441 does **NOT** apply.

For information and to obtain copies of OSHA regulations contact:
OSHA Publications Office
P.O. Box 37535
Washington, DC 20013-7535
Phone: 202-219-4667
Visit the OSHA web site www.OSHA.gov

IEEE Standards
The Institute of Electrical and Electronics Engineers, Inc. is the world's largest technical professional society. IEEE Standards documents are developed in specific technical fields or related subjects by IEEE Technical Committees and represent a census of the broad expertise on the subject within the Institute as well as those activities outside of IEEE that have expressed an interest in participating in the development of the standard.
IEEE 1187-1996, IEEE Recommended Practice for Installation Deign and Installation of Valve-Regulated Lead-Acid (VRLA) Storage Batteries for Stationary Applications.
IEEE 1188-1996, IEEE Recommended Practice for Maintenance, Testing, and Replacement of Valve-Regulated Lead-Acid (VRLA) Storage Batteries for Stationary Applications.
IEEE 1189-1996, IEEE Guide for Selection of Valve-Regulated Lead-Acid (VRLA) Batteries for Stationary Applications.

For information and to obtain copies of IEEE standards contact:
IEEE Customer Service
445 Hoes Lane
PO Box 1331
Piscataway NJ 08855-1331
Phone: (800) 701.4333 (within the US and Canada)
Phone: (732) 981.0060 (outside the US and Canada)
Fax: (732) 981.9667
Email: customer.service@ieee.org
Visit the IEEE web site:
www.standards.ieee.org

The National Fire Protection Association
The National Electrical Code, NFPA-70, addresses proper electrical systems and equipment installation to protect people and property from hazards arising from the use of electricity in buildings and structures.

For information contact:
National Fire Protection Association
1 Batterymarch Park
P.O. Box 9101
Quincy, MA 02269-9101
Phone: (617) 770-3000
Fax: (617) 770-0700
NFPA Customer Service: 800-344-3555
Visit the NFPA web site: www.nfpa.org

Uniform Building Code (UBC)
Publishes by the International Conference of Building Officials (ICBO)
Code is used throughout the West.

For information contact:
International Conference of Building Officials
5360 Workman Mill Road
Whittier, CA 90601-2298
Resource Center: 800-336-1963
Building Standards: 800-423-6587 x3278
Visit the ICBO web site: www.icbo.org

Standard Building Code (SBC)
Published by the Southern Building Code Congress International, Inc. (SBCCI) Code is typically used throughout the Southeast.

For information contact:
Southern Building Code Congress International, Inc.
900 Montclair Road
Birmingham, AL 35213-1206
Phone: 205-519-1853
Publications orders: 888-447-2224
Visit the SBCCI web site: www.sbcci.org

National Building Code (NBC)
Published by the Building Officials and Code Administrators International, Inc. Code is adopted mostly in the Northeast and Midwestern states.

For information contact:
Building Officials and Code Administrators International, Inc.
4051 W. Flossmoor Road
Country Club Hill, IL 60478
Phone: 708-799-2300
Fax: 708-799-4981
Publications orders: 800-214-4321 x777
Visit the BOCAI web site: www.bocai.org

International Code Council
5203 Leesburg Pike, Suite 600
Falls Church, VA 22041
703-931-4533

The purpose of the International Code Council (ICC) Code Development Process is to prescribe the Rules of Procedure utilized in the continued development and maintenance of the International Codes (Codes). Code changes that are approved are incorporated into Codes of the BOCA, ICBO and SBCCI.

The ICC held public hearings on proposed code changes at the Code Development Hearings on March 19-29, 2001 for all voting members of BOCA, ICBO and SBCCI. These Code Changes involved Valve Regulated Lead-Acid (VRLA) Batteries. Code changes to the International Fire Code regarding VRLA batteries are listed below.

INTERNATIONAL FIRE CODE®

VRLA BATTERY CODE CHANGE PROPOSAL
(Note: All references to section numbers are to sections of the 2000 edition of the International Fire Code.)

PART I.
Section 202. New/Revised

Valve Regulated Lead-Acid (VRLA) Battery. See Section 602.1.

Vented (Flooded) Lead-Acid Battery. See Section 602.1

PART II.
Section 602.1 New/Revised

Vented (Flooded) Lead-Acid Battery: A lead-acid battery consisting of cells that have electrodes immersed in liquid electrolyte. Flooded lead-acid battery cells have a provision for the user to add water to the cell and are equipped with a flame-arresting vent which permits the escape of hydrogen and oxygen gas from the cell in a diffused manner such that a spark, or other ignition source, outside the cell will not ignite the gases inside the cell.

Valve Regulated Lead-Acid (VRLA) Battery: A lead-acid battery consisting of cells furnished with a valve that opens to vent the battery whenever the internal pressure of the battery exceeds the ambient pressure by a set amount. In VRLA batteries, the liquid electrolyte in the cells is immobilized in an absorptive glass mat (AGM cells or batteries) or by the addition of a gelling agent (gel cells or gelled batteries).

PART III.
Section 608.1 Stationary Lead-Acid Battery Systems

608.1 Scope. Stationary lead-acid battery systems using vented (flooded) lead-acid batteries having an electrolyte capacity of more than 50 gallons (189 L) used for facility standby power, emergency power, or uninterrupted power supplies shall comply with this section. Valve regulated lead-acid batteries are not subject to the requirements of this section, but shall comply with Section 609.

PART IV.
Section 609
Valve Regulated Lead-Acid (VRLA) Battery Systems

609.1 Scope. Valve Regulated Lead-Acid (VRLA) battery systems having an electrolyte capacity of more than 50 gallons (189 L) used for facility standby power, emergency power, or uninterrupted power supplies (UPS) shall comply with this section.

609.2 Safety Vents. VRLA batteries shall be equipped with self-resealing flame-arresting safety vents.

609.3 Thermal Runaway. VRLA battery systems shall be provided with a Listed device or other approved method to preclude, detect, and control thermal runaway.

609.4 Room Design and Construction. Enclosure of VRLA battery system rooms shall comply with the *International Building Code.* The battery systems are permitted to be in the same room with the equipment they support. When VRLA battery systems are installed in a separate equipment room accessible only to authorized personnel, they may be installed on an open rack for ease of maintenance. When a VRLA battery system is situated in an occupied work center, it shall be housed in a noncombustible cabinet or other enclosure to prevent access by unauthorized personnel.

609.5 Neutralization. An approved manual method and materials for the neutralization of a release of electrolyte shall be provided. The method and materials shall be capable of controlling and neutralizing a release of 3% of the capacity of the largest VRLA cell or block in the room to a pH between 7.0 and 9.0.

609.6 Room Ventilation. Ventilation shall be provided to limit the maximum concentration of hydrogen to 1% of the total volume of the room during the worst-case event of simultaneous “boost” charging of all the batteries in the room. Where calculations are not provided to substantiate the ventilation rate, continuous ventilation at a rate of not less than one cubic foot per minute per square foot (1 ft^3/min/ft^2) [(0.0051 m^3/(s • m^2)] of floor area of the room shall be provided. The ventilation shall be either mechanically or naturally induced.

609.7 Cabinet Ventilation. Where VRLA batteries are installed inside a cabinet, the cabinet shall be vented. The cabinet ventilation shall limit the maximum concentration of hydrogen to 1% of the total volume of the cabinet during the worst-case event of simultaneous “boost” charging of all the batteries in the cabinet. Where calculations are not provided to substantiate the ventilation rate, continuous ventilation at a rate of not less than one cubic foot per minute per square foot (1 ft^3/min/ft^2) [(0.0051 m^3/(s • m^2)] of floor area covered by the cabinet shall be provided. The ventilation shall be either mechanically or naturally induced. The room in which the cabinet is installed shall also be ventilated as in 609.6.

609.8 Signs. Doors into electrical equipment rooms containing VRLA battery systems shall be provided with approved signs. The signs shall state that the room contains lead-acid battery systems and contains energized electrical circuits. Where VRLA batteries are contained in cabinets in occupied work centers, the cabinet enclosures shall be located within 10 feet of the equipment that they support. The cabinets shall have exterior labels that identify the manufacturer and model number of the system and electrical rating (voltage and current) of the contained battery system. Within the cabinet there shall be signs that indicate the relevant electrical, chemical, and fire hazards.

609.9 Seismic Protection. The battery systems shall be seismically braced in accordance with the *International Building Code.*

609.10 Smoke Detection. An approved automatic smoke detection system shall be installed in rooms containing VRLA battery systems in accordance with Section 907.2.

3.0 Receiving and Storage

3.1 Inspecting Batteries Upon Arrival

• During delivery (at the time of unloading from carrier) visually inspect each box for any indication of damage in transit.
(See figure 3.1)

Figure 3.1
Inspect boxes during delivery

• Check the contents of the shipment against the packing list. Report any missing parts to your Panasonic account manager immediately.
• If exterior box damage is evident, open the box(s) and inspect for any internal damage. Remove accessories from packaging.
• Note on the shipping documents/bill of lading receipt date, inspection results describing the damage and notify the Carrier (preferably before the carrier leaves), and your Panasonic account manager.
• Never lift cells by their terminal posts. Always lift batteries using proper equipment such as a forklift or a mobile crane. **IMPORTANT**: Make sure that lifting equipment used has lifting capability needed to safely lift batteries.

3.2 Damage and Missing Parts

Batteries are shipped FOB factory, that is, title/ownership passes to the ship-to/end-user at the factory shipping dock. All claims MUST be filed with the carrier for damaged shipments and/or missing boxes.
If individual battery parts are missing, contact your Panasonic Account Manager immediately and file a shortage report.

3.3 Unpacking and Handling

MSE cell models 150, 200, 300 and 500 are shipped from the factory fully charged, filled with electrolyte and in an individual box separate from (**NOT** assembled into) the rack modules. Cells are assembled into the rack modules at the installation site. Figure 3.2 shows a typical MSE-500 system assembly.

MSE cell models 960 through 1440 are shipped from the factory fully charged, filled with electrolyte, assembled INTO battery rack modules and shipped upright (but **NOT** interconnected) ready for stacking into a HORIZONTAL/UPRIGHT system position. Figures 3.3 through 3.5 show typical shipment pallets.

Accessories are shipped in separate boxes strapped onto a pallet of batteries or on a separate pallet(s). (See figure 3.3)

Figure 3.2
MSE-500 Module Assembly

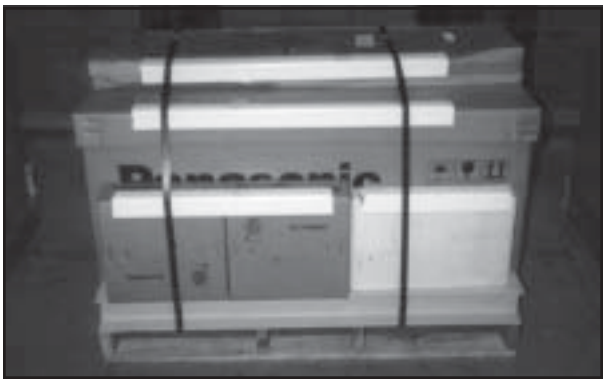


Figure 3.3
Accessories / I-Beam attached to pallet

Figure 3.4
Accessories / I-Beam attached to pallet

Base beams and rack module assemblies are bolted together to a wooden pallet. Remove bolts before handling. (See figure 3.5)

Figure 3.5
MSE 1440 assemblies are shipped upright

Forklifts or mobile lift cranes used for handling battery rack modules must be checked to make sure they can safely handle battery weight. NEVER lift more than one (1) battery module at a time.

WARNING:

DO NOT lift, carry, install or move cells by lifting or pulling on the terminal posts because terminal posts and post seals will be damaged. Lifting or pulling MSE cells by their terminal posts will VOID the Warranty.

DO NOT remove the cell vent covers or pressure relief valves, as this will void the Warranty.

3.4 Battery Storage

• If batteries are not put into service immediately, they should be stored in a clean, dry, cool and well-ventilated area.
• Batteries should not be exposed to direct sunlight.
• Recommended storage temperature is 50°F to 77°F (10°C to 25°C) for six months.
• Storage at higher temperatures will accelerate rates of battery self-discharge, may cause permanent cell degradation, shorten life. Storage time at higher temperatures is less than six months.
• **DO NOT** stack pallets as damage may occur.
• **DO NOT** store cells for more than six months from the date of manufacture without a boost charge. Storage for more than six months without a boost charge may cause permanent cell degradation and VOID the Warranty.

3.5 Installation Site Recommendations

(Before You Begin Installation)
• Make sure installation personnel are familiar with all safety and battery installation procedures.
• Check that cells, battery modules and accessories are all complete to begin installation.
• Make sure the proper tools and lifting equipment are available at the site.
• Inspect area where battery is to be installed.
NOTE: Make sure the floor is level and capable of supporting the battery.
• Consult applicable building codes and regulations. See Panasonic MSE Technical Notes No. 4 for more information.
• Understand the layout of the battery room to allow sufficient clearance around the battery.
• Before battery is anchored to the floor, measure and drill holes in floor to accept anchors prior to installation of the battery rack module. Follow manufacturer's directions.

4.0 Battery Installation

4.1 Battery Room

• The battery room should have a level floor, good lighting and be clean, cool, dry and well ventilated.
• 68°F - 77°F (20°C - 25°C) is the preferred operating temperature range that provides best battery life and performance.
• Higher temperatures will reduce battery life.
• Avoid locations where the battery is exposed to direct sunlight or hot or cold air sources as this may impact battery performance.
• Display Battery Warning Notices and Safety Precautions in Battery Room.
WARNING: DO NOT install the battery in a non-ventilated room.

4.2 Battery Room Floor

• Make sure the floor of the battery room can support the battery. Batteries consist of a floor mounting base beam and battery rack modules ready for stacking into a horizontal/upright system.
• The battery floor mounting base has provisions for floor anchoring. Floor anchoring is the responsibility of the user and **is mandatory**. Consult local building codes and regulations for specific requirements.

4.3 Battery Rack Base Beam Layout

• Battery rack assembly consists of floor mounting base beams and stackable battery rack modules mounted on top of the supplied mounting base beams.
• Before installation, locate the area designed for the battery and mark the floor with the system outline dimensions.
• Be sure to provide access space all around the battery for installation and maintenance.
NOTE: NFPA-70 recommends a minimum of 36 inches for aisle width for servicing and inspection of batteries. Provide at least four inches of space from the back, right or left side of the rack module assembly to a wall, parallel rack assembly or other equipment.
• Using the template provided, locate the base beams and the floor anchors. Consult applicable building codes and regulations for requirements. Floor anchoring is the responsi-

bility of the user. Follow manufacturer's directions.
• Remember to identify cell polarity location of the first module to be installed. Modules are assembled with the opposite polarities next to each other. Consult the battery assembly drawing provided with the shipment.
• Place the base beams over floor anchors. Position bottom module box on base beams to check alignment. Once the floor mounting base beams is in position and level, torque the floor anchors.
• **NOTE**: If the base beams are not level, use shims to level. A level base is important for the stability and safety of the battery modules.

4.4 Battery Rack Module Assembly

• Remove one (1) rack module from the pallet. **IMPORTANT: DO NOT** unbolt/remove more than one (1) module at a time.
• Modules are designed to be handled using lifting straps or flat lift.
• Attach lifting straps diagonally across the module using the channel end holes as attachment points.
• Be sure the hooks are attached properly. The hooks should point outward.
• Lift the module and place onto the base beam aligning with bolt holes. Confirm polarity of module from assembly drawing before inserting long bolts, washers and nuts.

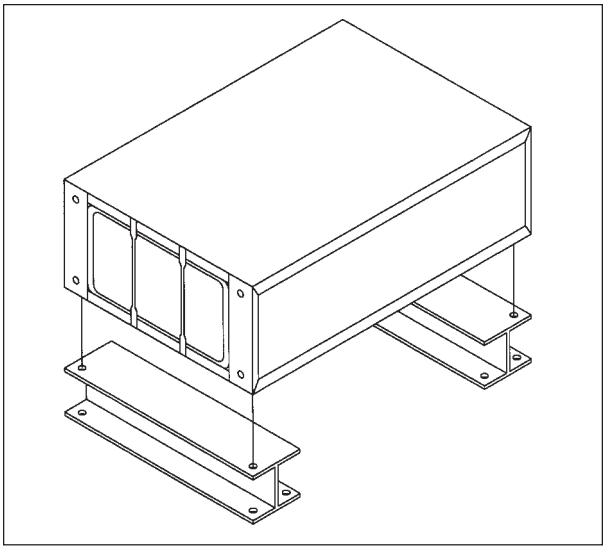


Figure 4.3
Horizontal First Module Placement

• When all bolts are in place, check assembly to be plumb and level. Use floor shims (user-supplied) to level if necessary and then tighten the bolts.
• Place the next rack module on top of the first. Remember the modules are assembled with the **opposite polarities** {(RED cell polarity marker for the positive terminal (+) post and BLACK polarity marker for the negative terminal post (-)} next to each other. Properly align modules and bolt holes and insert long bolts, washers and nuts. Hand tighten bolts. Repeat for additional modules.
• Once all modules are in place, tighten each bolt to 212 in-lbs torque.

NOTE: MSE cell models 150, 200, 300 and 500 are shipped from the factory fully charged, filled with electrolyte and in an individual box separate from (**NOT** assembled into) the rack modules. Cells are assembled into the rack modules at the installation site.

5.0 Battery Electrical Connection

ALWAYS WORK WITH THE BATTERY ON OPEN CIRCUIT (NO LOAD APPLIED) AND UNGROUNDED. BATTERY GROUND CONNECTIONS SHOULD BE MADE LAST.

5.1 Preparing for Electrical Connections

• Bolting tin-plated copper inter-cell connectors to the cell posts on the battery makes battery cell connections. Consult the battery system assembly drawing for details.
• **FOR MSE 150, 200 and 300 cells;**
•These cells have lead terminal posts and are greased at the factory to prevent oxidation
• Use a dry cloth and remove any factory-applied grease coating from the contact area of the terminals.
• Lightly brush terminal posts with a soft nylon brush to clean the terminal post. **CAUTION**: DO NOT use steel brushes, as these will damage terminal post area. DO NOT use cleaning solvents
• Panasonic supplies No-Ox-Id grease for use on the terminal posts to prevent corrosion.

• Apply a light coat of heated No-Ox-Id grease to the terminal posts with a small nylon brush BEFORE inter-cell connector assembly.

• **FOR MSE 960 through 1440 cells;**

• These cells have tin-plated brass terminal posts and are NOT greased at the factory.

• These terminal posts DO NOT require No-Ox-Id grease.

5.2 Installing the Inter-Cell Connectors

• All cell terminal posts are marked with a RED polarity marker for the positive (+) terminal post and a BLACK polarity marker for the negative terminal post (-).

• **IMPORTANT**: USE INSULATED TOOLS AND WEAR EYE PROTECTION, INSULATED GLOVES AND SAFETY SHOES.

• Inter-cell connections are made by bolting the tin-plated lead copper inter-cell connectors to the cell terminal posts of opposite polarity on the cells. Use the inter-cell connector assembly drawing, which provides details for the specific battery assembly.

Figure 5.1
Inter-Cell Connectors MSE-1440
Finger Tightening

• **IMPORTANT: ALWAYS START INTER-CELL CONNECTOR ASSEMBLY WITH THE TOP ROW OF CELLS WORKING DOWN TO THE SECOND ROW AND THEN THE NEXT. INSTALL THE TOP BOLT OF EACH INTER-CELL CONNECTOR FIRST.**

• Bolt the inter-cell connectors according to the assembly drawing using the connector bolts and washers to connect the terminal posts.

• **NOTE**: Varying lengths of inter-cell connectors are provided to complete the cell-to-cell and rack module-to-module connections.

• Make all connections finger-tight to allow for adjustment of position if necessary.

• After all inter-cell connections are made, torque according to table below. USE AN INSULATED TORQUE WRENCH ONLY.

• DO NOT over-torque the bolts as this may damage the terminal post seals.

Applied Storage Battery	Type of Bolt	Screw Torque in/lb
MSE-150,200,300,500	M10	155 in/lb
MSE-560-1440	M6	41 in/lb

Figure 5.2
Hand Tightening Battery Termination on MSE-500

5.3 Module Safety Shield Assembly

• Individual clear plastic shields are provided to prevent accidental contact with the battery terminal posts.

• Fasten four safety shield standoffs to the module by hand. Secure standoffs finger-tight. Install the shields. (See figure 5.3 and figure 5.4).

• **NOTE**: Safety shield faceplates have pre-drilled openings (holes) to allow probes to measure individual cell voltage readings.

Figure 5.3
Attach four shield standoffs by hand

Figure 5.4
Attach safety shield with fastening nuts

5.4 Battery Rack Inter-Face Adapter Plate for Power Plants (Optional)

• MSE batteries can be provided with an interface adapter plate so that a DC power plant can be mounted on the top of the MSE battery. Consult your Panasonic Account Manager for the availability of the optional interface adapter for your DC power plant.

5.5 Battery System Final Assembly

• After torquing all battery connections and with the battery on open circuit (no load applied) voltage, check each individual cell voltage and total battery voltage using a DC voltmeter. (See figure 5.5).

• Total battery voltage is the voltage of each individual cell multiplied by the number of cells in the battery system. Record individual cell and total battery voltage readings for comparison with later cell voltage readings.

Figure 5.5
Check cell voltage after system assembly

6.0 Battery Operation

6.1 Float Charge

• Standby batteries are normally permanently connected to a load which is powered at all times. When connected to a load in parallel with a power supply, standby batteries provide no-break service to the load in the event of a power failure or brownout. When a power supply keeps the battery fully charged and also supplies the load, the operation is known as a floating battery system.

• In normal float service, the battery is maintained in a fully charged condition. In the event of a power failure, the battery powers the load alone and a discharge occurs. Deep and/or frequent discharges (cycling), can shorten battery life, even with proper maintenance. Normal battery life may be expected in full float service at 68°F - 77°F (20°C - 25°C).

6.2 Equalizing Charge/Boost Charge

• It should not be necessary to equalize charge batteries when floated at recommended voltages. An equalizing charge delivers a higher voltage than the normal float voltage to restore full charge voltage to a battery.

• Batteries lose part of their charge due to self-discharge during shipping and storage. A supplemental or boost charge is required as follows:

(1) 2.23V-2.25V / cell constant potential charge is the standard boost charge. The time necessary for the boost charge, including standard voltage, is shown in the table below.

OCV	Time of Supplemental/ Boost Charge	Max Charge Current
2.23v/cell 2.25v/cell	(24 - 32 hours)	0.1C - 0.4C
2.28v/cell	(15 - 20 hours)	
2.33v/cell 2.40v/cell	(3 - 4 hours) (2 - 3 hours)	

Time of supplemental charge may vary depending on the length of storage.
C shows eight (8) hour rate capacity.
NOTE: Do not charge over 2.40V / cell because it may cause over charge or abnormal heating.

(2) If it is likely that the temperature of the storage battery will exceed 114°F, stop charging to prevent the battery from becoming hot.

(3) A part of the battery case may swell or contract during charging. This is caused by an imbalance of gas in the battery and is normal. You may continue using the battery.

(4) Just after starting supplemental/boost charging, the battery voltage may be out of reference value (+0.10V / cell). Continue charging as it will gradually return to normal values.

6.3 Operating Temperature Range

• Normal battery operating temperature is 68°F - 77°F (20°C - 25°C). Higher temperatures have the following effects:

- Shorten battery life
- Increase internal self discharge
- Increase charging current

• Lower operating temperatures have the opposite effect. In general, at float voltage, a battery operating at normal temperatures will last longer than one operating at higher temperatures.

7.0 Battery Routine Maintenance

7.1 Record Keeping

• Records of battery/cell operation and maintenance should be dated, recorded and kept in a permanent file. Data on corrective actions and the results of tests should also be recorded. (See Battery Maintenance Record Data Sheet, page 23). Make copies of record form as necessary.

7.2 Monthly Inspection

• Conduct a visual inspection of the battery system and refer to Table 1 (page 17) for procedures and actions.

7.3 Semi-Annual Inspection

• Conduct a visual inspection of the battery system and refer to Table 2 (page 17) for procedures and actions.

7.4 Annual Inspection

• The annual check is composed of the following items and items described in the semi-annual inspection in Table 2 (page 17).

Item	Action	Standard
Connecting Parts	Check torque of bolts and nuts	Follow torque requirements

Applied Storage Battery	Type of Bolt	Screw Torque in/lb
MSE-150,200,300,500	M10	155 in/lb
MSE-560-1440	M6	41 in/lb

Monthly Inspection - Table 1

Item	Contents	Standard	Action
1. Total battery string voltage under float charge.	Check the indicated value with voltmeter.	2.23-2.25 Vpc (77°F) x number of cells in series string.	Adjust voltage to meet specification if required
2. Visual inspection of the battery system.	Check for the electrolyte leakage around terminal area or vent cap.	NO LEAKAGE PERMISSIBLE	If any electrolyte leakage is found, clean the area with water. CONTACT PANASONIC IMMEDIATELY.

Semi-Annual Inspection - Table 2

Item	Contents	Standard	Action
1. Total battery voltage under charge.	Check the indicated value with voltmeter.	2.23-2.25 Vpc (77°F) x number of cells in series string.	(1) Adjust voltage to meet float specification if required. (2) If battery string total voltage requires frequent adjustment check charger and contact Panasonic.
2. Voltage of each cell during float charge.	Measure the float voltage of each cell.	Voltage tolerance ± 0.10 Vpc.	Record cell # and location. Monitor on Monthly Check Cycle. If cell remains out of tolerance contact Panasonic.
3. Visual inspection of the battery system.	Check for electrolyte leakage around terminal area or vent cap.	NO LEAKAGE PERMISSIBLE	If any electrolyte leakage is found clean the area with water. CONTACT PANASONIC IMMEDIATELY.
	Check for dust or dirt.		Clean with damp cloth.
	Check MODULE FRAME for rust, nicks, scratches.		Sand lightly and paint.

7.5 Clean Up

• Keep battery and its surrounding area clean.
• Clean plastic cover and cell cases, wipe with damp cloth to avoid generating static electricity. Never use organic solvents, such as thinner, gasoline, benzene and alcohol. (If you use organic solvents for cleaning, it may cause cracks in battery case and cover).

7.6 Storage

• When storing battery, disconnect from charger and load. Store in a dry cool place.
• Boost charge battery every six months.

7.7 Safety Procedures During Checks

• When you check or clean the battery, put on rubber gloves to avoid getting electrical shock.

• The battery may generate flammable gas when in use, which can explode when near fire, such as sparks or a cigarette. For safety's sake, do not expose battery to fire or sparks.
• Never dismantle battery. If sulfuric acid contacts your skin or clothes, wash with water immediately. If it gets in eyes, wash with water first and get medical care immediately.
• The battery room should be kept well ventilated.
• Though the allowable operation temperature range of this battery is from 5°F to 113°F (-15°C to 45°C), it is preferable to use within the temperature range from 68°F to 77°F (20°C to 25°C).
• Do not open or remove the vent caps.

MATERIAL SAFETY DATA SHEET

Section I: Chemical Product and Company Identification

Product Identity: VRLA Lead Acid Battery

Trade Name: Panasonic MSE Valve Regulated Lead Acid Battery Series

Distributor:
Panasonic Industrial Company - North American Sales
Two Panasonic Way, Secaucus, New Jersey 07094

Manufacturer:
Matsushita Battery Industrial
Osaka, 570, Japan

For Chemical Emergency
Spill, Leak, Fire, Exposure or Accident
Call CHEMTREC – Day or Night - 24 hours
1-800-424-9300
Outside the USA: 1-703-527-3887 (collect)

Telephone Number for General Information
Toll Free 1-800-793-3772
Internet: www.panasonic.com/batteries

Section II: Hazardous Ingredients / Identity Information

Component	Common Name	Chemical Name	Approximate % by wt. or vol.	OSHA PEL	ACGIH TLV	CAS#
Lead	(Negative Electrode and Grid)	Pb	48~53 wt%	0.05 mg/m^3	0.15 mg/m^3	7439-92-1
Lead Oxide	(Positive Electrode)	PbO	23~26%	0.05 mg/m^3	0.15 mg/m^3	1317-36-8
Lead Sulfate	(Positive and Negative Electrode)	$PbSO_4$	< 1. wt%	0.05 mg/m^3	0.15 mg/m^3	7446-14-2
Sulfuric Acid	(Electrolyte)	H_2SO_4	7~10 wt%	1.0 mg/m^3	1.0 mg/m^3	7664-93-9

Percentages of components are dependant both on the model of the battery and state of charge/discharge of the battery. Sulfuric Acid and Lead are reportable under Sections 302, 311, 312 and 313 of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (40 CFR 355 and 372). Reportable Quantity: 500 lbs for sulfuric acid and 10,000 lbs for lead. See Section XII, Page 4 for more information.

Overall Chemical Reaction: $PbO_2 + Pb + 2H_2SO_4 \rightleftharpoons 2PbSO_4 + 2H_2O$

Note: Panasonic Valve Regulated Lead Acid batteries are a non-spillable design. Under normal use and handling the customer has no contact with the internal components of the battery or the chemical hazards. Under normal use and handling these batteries do not emit regulated or hazardous substances. Warning: Battery terminals/posts and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. The only possible exposure would be the terminal posts on MSE models 150, 200 and 300. MSE models 500 through 1440 do NOT have lead terminal posts, but are tin-plated brass terminal posts. Wash hands thoroughly after working with batteries and before eating, drinking or smoking.

Section III: Physical / Chemical Characteristics

Boiling Point: Electrolyte 110°C - 112°C
Vapor Pressure: Electrolyte 11.7 mm Hg. at 20°C
Vapor Density (AIR = 1): Electrolyte 3.4
Solubility in Water: Lead, Lead Oxide and Lead Sulfate are insoluble in water. Sulfuric Acid is 100% soluble in water.
Appearance and Odor: The entire battery is a solid article consisting of an opaque plastic case with two protruding lead terminals or tin-plated brass terminals. The battery is odorless. Sulfuric Acid is a liquid.
Specific Gravity (H2O = 1) Electrolyte 1.300

Health Hazard Information (Acute and Chronic) - Sulfuric Acid only.

The International Agency for Research on Cancer (IARC) has classified “strong inorganic acid mist containing sulfuric acid” as a Category I carcinogen, a substance that is carcinogenic to humans. This classification does not apply to liquid forms of sulfuric acid or sulfuric acid solutions contained within the battery. Inorganic acid mist (sulfuric acid mist) is not generated under normal use of this product. Misuse of the product, such as overcharging, may however result in the generation of sulfuric acid mist.

Routes of Entry: By inhalation (mist), skin and eyes, ingestion.
Acute: Tissue destruction on contact. May cause 2nd and 3rd degree burns or blindness. Ingestion will cause corrosive burns on contact. May be fatal if swallowed.
Chronic: Inhalation of mists may cause upper respiratory irritation.
Signs and Symptoms: Irritation and burning of exposed tissues.
Medical Conditions: Respiratory disorders may be aggravated by prolonged inhalation of mists.

Section IV: Emergency and First Aid Procedures

Battery Electrolyte

Inhalation:	Remove to fresh air. Give oxygen or artificial respiration if needed. **Get immediate medical attention.**
Eye Contact:	Flush with plenty of water for at least 15 minutes. **Get immediate medical attention.**
Skin Contact:	Remove contaminated clothing and flush affected areas with plenty of water for at least 15 minutes.
Ingestion:	Do not induce vomiting. Dilute by giving large quantities of water. If available give several glasses of milk. Do not give anything by mouth to an unconscious person. **Give CPR if breathing has stopped. Get immediate medical attention.**

Section V: Fire and Explosion Hazard Data

Flash Point:	Not Applicable
Flammable Limits:	Lower 4.10% (Hydrogen gas) Upper 74.20%
Extinguishing Media:	Dry chemical, foam, halon or CO_2.

Special Fire Fighting Procedures:
If batteries are on charge, turn off power. Use positive pressure, self-contained breathing apparatus in fighting fire. Water applied to electrolyte generates heat and causes it to splatter. Wear acid resistant clothing. Ventilate area well.
Unusual Fire and Explosion Hazards:
Hydrogen and oxygen gases are generated in cells during normal battery operation or when on charge. (Hydrogen is flammable and oxygen supports combustion). These gases enter the air through the vent caps during battery overcharging. To avoid risk of fire or explosion, keep sparks and other sources of ignition away from the battery. Do not allow metal objects to simultaneously contact both positive and negative terminal of batteries. Ventilate area well.

Section VI: Reactivity Data

Stability:	Stable under normal conditions.
Conditions to Avoid:	Sparks and other sources of ignition. Prolonged overcharge. Fire or explosion hazard due to possible hydrogen gas generation.

Incompatibility:
Combination of sulfuric acid with combustibles and organic materials may cause fire and explosion. Avoid strong reducing agents, most metals, carbides, chlorates, nitrates, picrate.
Hazardous Decomposition Products: Hydrogen gas may be generated in an overcharged condition, in fire or at very high temperatures. CO, CO_2 and sulfur oxides may emit in fire.
Hazardous polymerization will not occur.

Section VII: Precautions for Safe Handling and Use

Steps to be Taken in Case of Broken Battery Case or Electrolyte Leakage:
Neutralize any electrolyte or exposed internal battery parts with soda ash (sodium bicarbonate) until fizzing stops. Keep untrained personnel away from electrolyte and broken battery. Place broken battery and clean-up materials in a plastic bag or non-metallic container. Dispose of clean-up materials as a hazardous waste. Ventilate area as hydrogen gas may be given off during neutralization.
Waste Disposal Method:
Federal and State laws prohibit the improper disposal of all lead acid batteries. The battery end users (owners) are responsible for their batteries from the date of purchase through their ultimate disposal. The only legally acceptable method of disposal of lead acid batteries is to recycle them at a Resource Conservation and Recovery Act (RCRA) approved secondary lead smelter. The Panasonic SAV-LEAD Recycling Program allows for the recycling of lead-acid batteries in an environmentally sound manner. For more information on the SAV-LEAD Recycling Program call toll-free, 1-800-SAV-LEAD (1-800-728-5323). These batteries are chemically identical to common automotive starter batteries and can be recycled with automotive lead-acid batteries.

HAZARDOUS WASTE CODES: D002, D008.

Precautions to be Taken in Handling, Storing and Transportation:
Store in cool, dry area away from combustible materials. Do not store in sealed, unventilated areas. Avoid overheating and overcharging.
Other Precautions:
Do not charge in unventilated areas. Do not use organic solvents or other than recommended chemical cleaners on battery.

Section VIII: Control Measures / Personal Protection

General:
Normal room ventilation is sufficient during normal use and handling. Recommend 2 to 3 room air changes per hour to prevent buildup of hydrogen gas.
Personal Protective Equipment (In the Event of Battery Case Breakage):
Always wear safety glasses with side shields or full face shield.
Use rubber or neoprene gloves.
Wear acid resistant boots, apron or clothing.
Work/Hygienic Practices:
Remove jewelry, rings, watches and any other metallic objects while working on batteries. All tools should be adequately insulated to avoid the possibility of shorting connections. DO NOT lay tools on top of battery. Be sure to discharge static electricity from tools and individual person by touching a grounded surface in the vicinity of the batteries, but away from cells. Batteries are heavy. Serious injury can result from improper lifting or installation. DO NOT lift, carry, install or remove cells by lifting or pulling the terminal posts for safety reasons and because terminal posts and post seals may be damaged. DO NOT wear nylon clothes or overalls as they can create static electricity. DO KEEP a class "C" fire extinguisher and emergency communications device in the work area.
IMPORTANT:
Wash hands thoroughly after working with batteries and before eating, drinking or smoking.

Section IX: Regulatory Information

NFPA Hazard Rating for Sulfuric Acid:
Flammability (Red) = 0 Health (Blue) = 3 Reactivity (Yellow) = 2

Section X: Transportation Information

DOT - Unregulated, meets the requirements of 49 CFR 173, 159 (d).
IATA/ICAO - Unregulated, meets the requirements of Special Provision A67.
IMO - Unregulated.
IMPORTANT:
For all modes of transportation, each battery and outer package must be labeled: "Non-Spillable" or "Non-Spillable Battery." This label must be visible during transportation. Batteries must be securely packed to prevent short circuiting.

Section XI: California Proposition 65 Information

The State of California has determined that certain battery terminals contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. The only possible exposure would be the terminal posts on MSE models 150, 200 and 300. MSE models 500 through 1440 do NOT have lead terminal posts, but are tin-plated brass terminal posts. IMPORTANT: WASH HANDS THOROUGHLY AFTER WORKING WITH BATTERIES AND BEFORE EATING, DRINKING OR SMOKING.

Section XII: Other Information

MSE Valve Regulated, Lead-Acid (VRLA) Battery Electrolyte Data for Environmental Reporting Purposes Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA)
MSE batteries are manufactured using lead, CAS No. 7439-92-1 and electrolyte (sulfuric acid) CAS No. 7664-93-9, which are subject to the reporting requirements of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA), EPCRA is intended to provide the public with information about hazardous substances in their communities and to assist in establishing emergency response plans for chemical accidents. Section 302 requires notification if you have more than 1,000 lbs. of sulfuric acid. Section 304 says that the Reportable Quantity for a spill is 1,000 lbs. for sulfuric acid. CERCLA also has a 1,000 lb. spill reporting requirement. Section 312 requires Annual Inventory Reporting on a Tier II form if you have 500 lbs. of sulfuric acid or 10,000 lbs. of lead. Section 313 requires Toxic Chemical Release Inventory "Form R" reporting if you have more than 10,000 lbs. of sulfuric acid or 100 lbs. of lead.

The quantity of electrolyte, sulfuric acid and lead will vary by MSE battery model. Consult the table on page 4 for MSE model number and corresponding information.

NOTE: Battery electrolyte is a mixture of sulfuric acid and water. Only the amount of 100% sulfuric acid must be counted in the reportable quantity.

MSE VRLA Battery Electrolyte Data Table

Cell MODEL NUMBER	(V)	Total Weight Kg/**(lbs)**	Lead Weight Kg/**lbs.**	ELECTROLYTE/Cell SP. GR	Volume (ml)/**gals.**	Weight (kg)/**lbs**	100 % SULFURIC ACID Weight/Cell (kg)/**lbs**	Volume **gals.**
MSE-150	2	12.0 / **26.4**	7.9 / **17.4**	1.27	1,730 / **0.457**	2.19 / **4.83**	0.79 / **1.74**	0.116
MSE-200	2	15.1 / **33.3**	10.6 / **23.4**	1.27	2,300 / **0.608**	2.92 / **6.43**	1.05 / **2.32**	0.155
MSE-300	2	21.7 / **47.8**	15.3 / **33.7**	1.27	3,400 / **0.898**	4.31 / **9.51**	1.55 / **3.43**	0.229
MSE-500	2	35.8 / **79.1**	21.5 / **47.4**	1.27	6,230 / **1.64**	7.91 / **17.42**	2.85 / **6.28**	0.419
MSE-960	2	136 / **134**	42.3 / **93.2**	1.31	10, 733 / **2.83**	14.06 / **30.97**	5.72 / **12.61**	0.842
MSE-1040	2	64.4 / **142**	45.6 / **100**	1.31	11,013 / **2.91**	14.42 / **31.77**	5.87 / **12.95**	0.864
MSE-1120	2	70.1 / **155**	49.0 / **108**	1.31	12,450 / **3.28**	16.30 / **35.92**	6.64 / **14.64**	0.977
MSE-1200	2	73.7 / **163**	52.3 / **115**	1.31	12,649 / **3.34**	16.57 / **36.49**	6.75 / **14.87**	0.992
MSE-1360	2	84.2 / **185**	59.0 / **130**	1.31	15,076 / **3.98**	19.74 / **43.50**	8.04 / **17.73**	1.183
MSE-1440	2	88.0 / **194**	62.3 / **137**	1.31	15,417 / **4.07**	20.19 / **44.48**	8.22 / **18.13**	1.209

General Product Description - MSE VRLA Batteries

MSE batteries are valve regulated, non-spillable lead-acid batteries with pasted lead-calcium plates. The electrolyte in the MSE battery is held captive in an Absorbent Glass Mat (AGM) separator between the plates that immobilizes the electrolyte in the cell. AGM separator material is a highly porous, absorbent micro fiberglass mat mixed with polymer fibers. There is NO "free" electrolyte to leak out if the cell is tipped over (cell case and cover are sealed together) or if the cell is punctured. The AGM separator material immobilizes the electrolyte and creates a situation where a spill of electrolyte is highly unlikely. Typical accidents where a VRLA battery case is punctured result in a slight drip or a slow ooze of material out of the cell that cannot be characterized as a spill.

VRLA batteries are also different from conventional vented (flooded cells) because they contain only a minimum amount of electrolyte. The largest size MSE cell, MSE-1440, contains only 4.07 gallons of 1.310 specific gravity electrolyte. Of those 4.07 gallons of electrolyte, only 1.209 gallons is 100% sulfuric acid. EPCRA reporting requires that only the amount (gallons) of 100% sulfuric acid is reportable.

VRLA battery electrolyte is a dilute mixture of sulfuric acid in water, which typically has a specific gravity between 1.270 and 1.300. Specific Gravity (Sp.Gr.) is a measure of the density of a liquid as compared to that of water, which has a Sp.Gr. of 1.000. Pure sulfuric acid has a specific gravity of 1.835.

NOTE: Panasonic MSE VRLA batteries do NOT contain a gel electrolyte.

During normal battery installation, operation and maintenance, the user has NO contact with the internal components of the battery or its internal hazardous chemicals.

Panasonic MSE batteries are UL recognized under the following file number: Matsushita Electric Industrial Co. Ltd., Matsushita Electric Corp. of America, File #MH13723, 1 Panasonic Way, Secaucus, NJ 07094.

NOTICE TO READERS: DISCLAIMER

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MSDS Preparation Date: 3/2002 Supersedes: 1/2002
Preparer: Charles P. Monahan Director, Regulatory Compliance 201-392-6464
Printed in the U.S.A.
Form No. MSDS-MSE-01/R4

Definition of Terms

Abbreviated Glossary of Sealed Lead-Acid Battery Terms

Ambient Temperature – Average temperature in vicinity of battery.

Capacity – Electrical capacity of a battery usually expressed in Ampere-Hours (Ah).

Cell – Minimum battery unit that comprises a storage battery. The nominal voltage of the cell of a lead-acid battery is 2.0 Volts.

Cut-off Voltage – The terminal voltage of a battery at which battery discharge should be discontinued. This voltage depends on discharge current, type of electrode and construction of battery.

Cycle Life – The number of charge/discharge/rest cycles a cell/battery can provide. Cycle life is usually expressed by the number of cycles available before duration of discharge decreases to a half of the initial value.

Electrolyte – The medium that conducts ions in the electrochemical reactions in batteries. Lead-acid batteries use a dilute mixture of sulfuric acid in water as the electrolyte.

Float Charge – Charging system in which a constant voltage is continuously applied to a battery connected to a rectifier in parallel with a load to maintain the battery in a fully charged state.

Overcharging – Continued charging of a fully charged cell/battery. Overcharging causes electrolysis of water, resulting in a rapid decrease of electrolyte. Generally, overcharging adversely influences battery life.

Rated Capacity – The stated capacity of a battery, namely, the ampere-hour amount which can be drawn from the battery in a fully charged state at a specified temperature, at a specified discharge rate, and to a specified cut-off voltage. For example, the MSE-1440 cell is rated for 1, 440 ampere-hours at 25ºF to 1.75 volts per cell at the 8-hour rate.

Sealed Lead-Acid Battery – Valve-Regulated (sealed) Lead-Acid Battery. A lead-acid battery consisting of sealed cells furnished with a valve that opens to vent the battery whenever the internal pressure exceeds the ambient pressure by a set amount. In VRLA batteries, the liquid electrolyte in the cells is immobilized in an absorptive glass mat (AGM cells or batteries) or by the addition of a gelling agent (gel cells or gelled batteries).

Specific Gravity (Sp. Gr.) – Is a measure of the density of a liquid as compared to that of water, which has a Sp. Gr. of 1.000. VRLA battery electrolyte is a dilute mixture of sulfuric acid in water, which typically has a specific gravity between 1.270 and 1.300.

(Product Discontinued And No Longer Available From Panasonic)

Panasonic

BATTERY MAINTENANCE RECORD DATA SHEET

Date _____

Company _____

Address _____

Battery Location and/or Number _____

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

Charger Output _____ Ambient Air Temperature _____ ºF

Total Battery Voltage _____ Power Panel Meter Volts _____

INDIVIDUAL CELL READINGS

Cell No.	Serial No.	Volts	Cell No.	Serial No.	Volts	Cell No.	Serial No.	Volts
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 _____

(Product Discontinued And No Longer Available From Panasonic)

Panasonic®

MSE MODULAR BATTERY SYSTEM

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