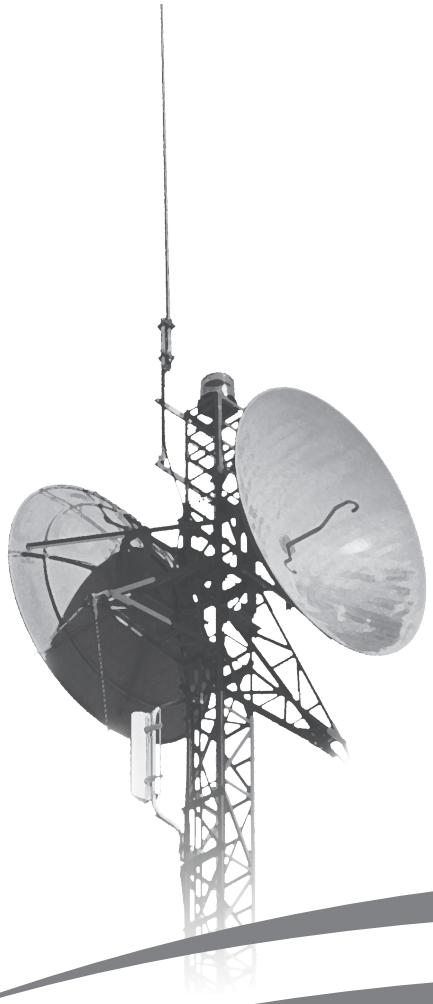
MOTOMA®

Power into the Future



Sealed Lead-Acid Batteries
Handling Book

Precautions for handling Motoma Valve Regulated Lead-Acid Batteries.

Please read the “Handling Book” entirety and its contents fully understood before handling or using Motoma rechargeable Valve Regulated Lead-Acid (VRLA) Batteries.

If there are any questions, please contact your local motoma power agents/ distributors.

Due to the potential energy stored in the batteries, improper handling or use of the batteries by not observing the precautions listed in the document may result in bodily injury caused by electrolyte leakage, heat generation, or explosion.

All descriptions are subject to modification without notice.

I. DANGER:
Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

II. WARNING:
Indicates a potentially hazardous situation which, if not avoided, could result in death or injury.

III. CAUTION:
Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or damage to equipment.

IV. RECOMMENDATION
Recommended course of action to prevent a situation that could result in damage of quality, performance or reliability of the batteries, should they be mishandled.

1. Even in cases where lead-acid batteries are handled improperly, a situation that will result in the immediate death of the users is highly unlikely. However, we have assumed the higher DANGER level situation instead of the WARNING and CAUTION levels because the high energy stored in batteries still implies a possibility of extreme hazard which might lead to serious injury.
2. Serious injury here would include injury, loss of eyesight, burns, electric shocks, bone fractures and poisoning that will cause permanent damage or require hospitalization or intensive treatment over an extended period. Minor injury includes slight burns and electric shock.. Property damage means damage to buildings and household effects including livestock and pets.
3. Recommendation refers to the suggested means by which to protect batteries from impaired quality, performance and reliability.

I.DANGER

1. Environment & Condition of use

1.1 Do not load valve-regulated lead-acid batteries (hereinafter described as “the battery”) in airtight equipment. Use of the battery in airtight equipment may cause explosion of the equipment or injury.

2.Installation

2.1 Insulate metallic tools such as torque-wrenches and wrenches with a vinyl tape, etc. Using un-insulated tools may cause a short circuit, and the heat or sparks generated by the short circuit could result in burns, damage to the battery, or ignite an explosion.

2.2 Do not place the battery in a closed room or near fire. Placing the battery in such a location could result in an explosion or fire due to hydrogen gas emitted by the battery.

3.Preparation prior to Operation

3.1 Be sure to provide enough insulation around the lead wires and/or plates used between the batteries and the application. Insufficient insulation may cause an electric shock, heat generating from a short circuit (or excess current) may result in an injury, burn, smoke or ignition.

4.Method of Use

4.1 The batteries must be charged using the specified charger or by maintaining the charging conditions indicated by Motoma Power. If the batteries are charged under conditions other than those specified by Motoma Power, they may leak, ignite or explode.

4.2 Do not connect the (+) and (-) terminals of the battery to each other with a metallic material such as wire; do not allow tools such as pipe wrenches and wrenches to touch points of different voltages on the battery; and do not bring metallic necklaces or hair pins into contact with the battery or store them together with the battery. Failure to observe these precautions may cause the battery to overheat, emit hydro gen gas, leak, ignite, or burst.

II.WARNING

1.Environment & Condition of use

1.1 Charge the battery using a specified charger or under the charging condition specified by Motoma. Charging the battery under any other conditions may cause the battery to overheat, emit hydrogen gas, leak, ignite, or burst.

1.2 When using the battery in medical equipment, provide a back-up system other than the main battery. Failure of the main battery in the absence of a back-up power could lead to injury.

1.3 Avoid direct contact of the battery with metallic containers; acid-and heat-resistant insulators should be employed. leakage of the battery in the absence of insulators may

cause problems such as release of fumes and ignition.

1.4 Do not place the battery near a device that may cause sparks(such as a switch or a fuse). The battery may generate flammable gas when charged, so remember to keep the battery away from fire Oran open flame to prevent any sparks from igniting or causing explosions.

1.5 Avoid placing the battery near a heat-generating part (such as a transformer).Using the battery near a heat source may cause the battery to overheat, leak, ignite, or burst.

1.6 In applications which use more than one battery, first make sure of correct mutual connections between batteries, and then connect the battery with the charger or the load. Make sure to firmly connect the (+) pole of the batteries to the (+) terminal of the charger or load, and the (-) terminal in the same way. If the poles/terminals of the batteries, the charger and the load are connected improperly, explosion, ignition or damage to the batteries and/or equipment may occur, causing injury to personnel in some cases.

1.7 Be extremely careful not to drop the battery onto feet to avoid the possibility of serious injury.

2.Installation

2.1 Do not contact any plastic or resin containing a migrating plasticizer with the batteries. Avoid using organic solvents such as thinner, gasoline, lamp oil, benzene and liquid detergent to clean the batteries. The use of any of the above materials may cause the containers and/or the covers (ABS resin) of the batteries to crack and leak, or could ignite, Avoid using material containing a migrating plasticizer by asking the manufacturer its contents.

2.2 Take safety measures such as wearing rubber gloves for insulation when handling a voltage of 45V or higher. Operation without safety measures may result in electric shocks to the operator.

2.3 Avoid placing the battery in an environment which is susceptible to floods. There is the possibility that if the battery is immersed in water, it may ignite or cause electric shocks to personnel.

3.Method of use

3.1 Do not throw the battery in fire nor heat the battery. The battery may burst or generate a toxic gas if placed in contact with fire.

3.2 Do not attempt to disassemble, remodel or destroy the battery, as it may cause battery leakage, fire or bursting, and could also create sulfuric acid spills from the battery resulting in possible burns to personnel and damage to the immediate environment.

3.3 Battery posts, terminals and related accessories contain lead and lead compounds and handling this products may also expose you to sulfuric acid mist, chemicals known may cause cancer and reproductive harm. Wash hands after handling.

4.Maintenance & Checking:

4.1 Clean the battery with a slightly damp cloth, ensure there is no excess water on the cloth by squeezing it well. Do not use a dry cloth or a duster, as it may cause the battery to

generate static electricity, leading to possible ignition and bursting of the battery.

4.2 Replace the battery with a new one within the time period specified in the instruction manual or equipment.

4.3 Follow the guideline which states the battery should be replaced when its capacity has decreased to 50% of the initial capacity (at an ambient temperature of 77℉(25℃) or below). In the trickle or float application of the battery (application as stand-by power) at an ambient temperature higher than 77℉(25℃), the period for which the battery can be used before replacement is shortened by a half for every 10℃ rise of temperature. When the discharge current becomes higher than 0.25CA, the run time and battery life is also shortened.

4.4 The usable period for the battery is markedly shortened near the end of its service life (when discharge time has decreased to 50% of the initial). This is also the period when battery problems such as internal short, dry-up of electrolyte (increase in internal resistance) and corrosion of the cathode grids will occur. Replace the battery before these conditions are reached: if the battery continues to be used under these conditions, maximum discharge current will continue flowing, which may lead to thermal runaway or leakage.

5. Emergency measures

5.1 The battery contains diluted sulfuric acid, a very toxic substance. If the battery leaks and the liquid inside spills on the skin or clothing, immediately wash it off with plenty of clean water. If the liquid splashes into eyes, immediately flush the eyes, immediately flush the eyes with plenty of clean water and consult a doctor. Sulfuric acid in the eyes may cause loss of eyesight and acid on the skin will cause burns.

The batteries should be used in non life critical medical equipment. When any medical equipment incorporating a motoma VRLA batteries is planned, please notify Motoma Power.

III. CAUTION

1. Environment & Condition of use

1.1 The operating temperature range for the battery is specified below. Use of the battery at temperatures beyond this range may cause battery damage.
Normal operating temperature of the battery is 77℉ (25℃)
Discharge: 5℉～122℉ (-15℃～50℃)
Charge: 32℉～104℉ (0℃～40℃)
Storage: 5℉～104℉ (-15℃～50℃)

1.2 Do not allow the battery to be immersed in or wetted with water/sea-water; as it may corrode the battery, ignite or create an electric shock hazard.

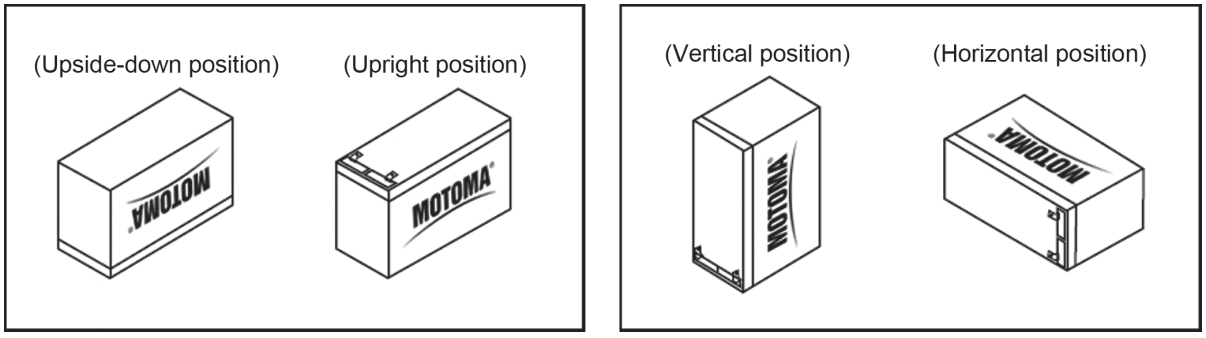
1.3 Do not place or store the battery in an automobile in hot weather, under direct sunlight, in front of a stove, or near fire. Use or storage of the battery in these places may cause battery leakage, fire or bursting.

1.4 Use of the battery in a dusty environment is not recommended, as it may cause the battery to short. The battery should be periodically checked when used in such an environment.

2.Installation

2.1 When unpacking the battery, make sure to handle it gently. Rough handling may shock the battery, causing damage. Check that the battery is free from cracks, fractures, tipping and leakage.

2.2 When loading the battery in equipment, mount it in the lower most section of the equipment in order to ensure easy checking, maintenance and replacement. Do not charge the battery in the inverted position: overcharging in the inverted position may cause battery leakage from the safety valve. The inverted position is demonstrated in the far left picture below where the letters “MOTOMA” on the battery in the picture are inverted. The following illustrations are for explaining positions of the battery, not for showing accurate configurations for each type of battery.



* Examples of plastic or resin to avoid: vinyl chloride, oily rubber.
Examples of acceptable types of plastic or resin: polyolefin resin such as polypropylene or polyethylene.

2.3 Do not carry the battery by hanging it from the terminal or the lead wire, as it may cause damage to the battery.

2.4 When carrying the battery, exercise caution not to apply a strong shock to it by dropping it, jarring it or causing it to collide with other objects, as this may cause damage to the battery.

2.5 Do not underestimate the weight of the battery. As it is heavy for its volume, careless handling of the battery may cause backache or other injuries to the operator.

2.6 Do not bring covered wires containing plasticizer or non-rigid PVC sheets in contact with the battery. Do not apply organic solvents such as paint thinner, gasoline, kerosene and benzene or liquid detergents to the battery. When brought in contact with these materials, the battery case may crack, causing leakage of the battery.

2.7 Do not cover the battery with a material which generates static electricity, such as a PVC sheet. A static charge may trigger fire or explosion.

2.8 In fastening bolts and nuts of the battery, observe the torque values specified: otherwise, sparks may be generated and damage of the terminal may occur.

Bolt (nut) size (mm)			Fastening torque		
Diameter	Pitch	Length	Nm	Kg. cm	Lb. in
M5 1.197(5)	0.031 (0.8)	0.591±0.039 (15±1)	2.0～2.9	20～30	17.3～26.0
M6 0.236(6)	0.039 (1.0)	0.787±0.039 (20±1)	3.9～5.4	40～55	34.6～47.6

2.9 Apply insulation covers to terminals, joint parts, bolts and nuts of the battery in order to prevent electric shocks to personnel.

2.10 When intending to use the battery in vibrating equipment such as motor cycles, engine driven bicycles and engine driven grass shears, please consult Motoma in advance.

2.11 Fasten the batteries firmly to the equipment to avoid the influence of vibration and/or physical shock.

3. Preparation Prior to Operation

3.1 Do not connect the battery directly to a power outlet or a cigarette lighter socket of an automobile without using a charger. Direct connection to power sources may cause battery leakage, heating or bursting.

3.2 Turn off the switch of the circuit when connecting the battery to a charger or a load.

3.3 If newly purchased batteries exhibit any irregularities in initial use, such as rusting, heating or other problems, they should not be used. Continued use of an irregular battery may lead to leakage, fire or bursting of the battery.

4. Unspecified Use

4.1 Do not place the batteries in an unspecified use or they may leak, ignite, or explode.

5. Method of Use

5.1 Check the battery for any sign of irregularities in appearance. If there is any damage to the battery case/cover such as cracks, deformation or leakage, replace the battery with a new one. If the battery appears dirty or dusty, clean it. If a battery of irregular appearance continues to be used, decrease of capacity, leakage of electricity, fumes, ignition or other problems may result.

5.2 If any irregularity is found in areas such as the charge voltage and discharge characteristics of the battery, replace it.

5.3 For safety, make sure to observe the following: otherwise, leakage, ignition or an explosion of the battery may occur.

① Do not charge the battery with its (+) and (-) terminals and the (+) and (-) terminals of the charge connected in reverse.

② Do not apply a solder directly to the battery terminals. If direct soldering is unavoidable, please contact MOTOMA in advance.

③ Avoid mixed usage of batteries differing in type, manufacturer or history of use.
④ Do not remove or damage the outer case of the battery.
⑤ Do not apply strong shocks or jolts to the battery.

5.4 Do not continue to charge the battery beyond the time specified in the instructions of use of the charger. If the battery is not fully charged even after being charged for a longer time than specified, discontinue charging and remove the battery from the charger. Charging for a longer time than specified may cause the battery to leak, ignite or burst.

5.5 Do not discharge the batteries beyond the maximum values indicated in the specifications. If the batteries are discharged beyond the maximum values, they may leak ignite or explode

5.6 Children should only use the battery under the guidance of an adult who should thoroughly instruct the child on its use. During use the adult should check that the battery is used exactly as instructed.
Keep the battery beyond the reach of small children. During charging or actual use of the battery, take caution not to allow small children to remove the battery from equipment.

6. Maintenance & Checking

6.1 Do not apply organic solvents such as paint thinner, gasoline, kerosene and benzene or liquid detergents to the battery. If there are brought into contact with the battery case, it may crack, causing leakage.

7.Emergency Measures

7.1 If any corrosion of the terminals, leakage or deformation of the case of the battery is found, do not use the battery and turn off the power supply. If a battery which is irregular or substandard in any way continues to be used, leakage, fire or bursting of the battery may occur and there is also a potential for electric shock.

8. Storage:

8.1 Store the battery in a stable position so as to keep the terminals of the battery away from any metallic or other conductive material (including items that may fall or drop onto the battery).

8.2 Protect the battery from rain. If the terminals of the battery come into contact with water, they may corrode.

8.3 Keep the battery in the upright position as a general rule, and do not apply abnormally strong vibrations or shocks to the battery. Transportation of the battery in an abnormal position or the application of abnormally strong vibrations or shocks to the battery may cause damage to the battery and the deterioration of characteristics.

8.4 When storing the battery, remove it from the equipment or disconnect it from the charger or the load and keep it in a place where temperature is low. Do not store the battery under direct sunlight or in high temperatures (140℉ (60℃) or higher) or in a highly humid atmosphere, because rusting, deterioration of performance and life of the battery may occur.

9. Disposal of Batteries

9.1 In countries where there are legal or voluntary regulations on the recycling of rechargeable batteries, please provide written information on recycling of rechargeable batteries with the equipment, packaging, instruction manuals, etc.

9.2 Adopt methods and measures for equipment design and battery mounting that will allow for easy removal of batteries for replacement and disposal.

9.3 Used batteries are recyclable. When returning used batteries, insulate their terminals with adhesive tapes, etc, otherwise the residual electricity in used batteries may cause a fire or explosion.

9.4 This battery is fully recyclable and should be accepted at any location that accepts common automotive starter batteries. Examples of places that accept these batteries are: County or municipal recycling drop-off centers, scrap metal dealers, and retailers who sell automotive replacement lead acid starter batteries.

IV. RECOMMENDATION

1. Environment & Condition of Use

1.1 Avoid sudden movements or applying shocks to the battery e.g. from dropping the battery. Damage and deterioration of battery characteristics may occur if the battery is dropped

1.2 Carefully check the life characteristics of the battery when in actual loaded mode. Life of the battery may vary greatly depending on charge/discharge conditions.

2. Installation

2.1 The battery/equipments should be installed by skilled personnel (specialists) such as personnel qualified for maintaining battery equipment. Handling of the battery by unskilled personnel may lead to dangerous errors.

3. Method of Use

3.1 The recommended cut-off voltage during discharge depends on the size of the discharge current. The relationship between the storage batter discharge current and the ideal discharge cut-off voltage is described in Motoma specifications and technical handbooks.
Do not continue discharging to the point where the voltage drops below the recommended discharge cut-off voltage.
If a storage battery that was discharged below the recommended discharge cut-off voltage is recharged, the storage battery may generate heat which could deform it or cause condensation to form on the batter casing due to the evaporation of moisture from inside the battery, Discharging below the recommended discharge cut-off voltage may also accelerate the deterioration of the battery's performance characteristics.

3.2 Avoid over-discharge, and charge the battery immediately after discharge. The instruction manual of the equipment should contain information telling the user not to over-discharge the battery and to charge the battery immediately after the use of the equipment (discharge). Even if discharge of the battery is stopped before voltage decreases to such a

level that the battery-driven equipment stops being operational, deterioration of the battery may be accelerated by the so-called sulphation phenomenon if it is not recharged after use. The low voltage cut-off circuit should be designed so that it can completely cut off the discharge current including a weak current.

3.3 If a charge method and a charge condition other than that described in the specification and the technical brochures is to be adopted, charge/discharge characteristics and life characteristics of the battery should be thoroughly checked in advance. The adoption of adequate charge methods and adequate charge conditions are crucial to ensure safe use of the battery and for fully utilizing the battery capacity.

3.4 For the cycle operation of the battery (application of the battery as the main source of power by repeating charge and discharge), use a charger which operates by controlling either the charge period or charge quantity. Continue charging the battery for the time specified or until the charge completion lamp, if provided, indicates completion of charge. If charging is suspended before completion, the service life of the battery may be shortened.

3.5 Avoid parallel charging of batteries in cycle use, as this may shorten the service life of the batteries by causing an imbalance in charge/discharge state among the batteries connected in parallel.

3.6 During trickle of float charge of the battery, measure the total voltage with a high-accuracy voltmeter of Class 0.5 or batter. If the voltage readout does not meet the specified value, investigate the reason and take proper measures. A total voltage that is lower than the specified value indicates insufficient charge which may reduce the battery capacity; a voltage higher than specified indicates an overcharge which may shorten service life of the battery or cause problems such as thermal runaway in some cases.

3.7 Make sure to turn off the switch of the battery equipment after use, otherwise excessive discharge may cause deterioration in battery performance and shorten service life.

3.8 When the equipment is not used for a long period, remove the battery from the equipment, chare it fully, and store it in a place where humidity is low. Unsatisfactory storage conditions may cause deterioration in battery performance, shorten service life and could cause rust to form on the terminals.

3.9 Since the batteries tend to lose a part of their capacity due to self-discharge during shipment and storage, recharge the batteries before you use them after purchase or long-term storage in order to restore their full capacity. Check for the following conditions before recharging:

Charging method	Charging condition (at 25℃)
Constant voltage	•Regulation range of the controlled voltage:7.25V to 7.45V/6V battery,14.5V to 14.9v/12v battery; Initial current:0.1CA to 0.4CA; Maximum charging time: 24 hours. •Short-time charge is possible when several batteries of the same model, under the same storage conditions can be charged in series. Otherwise they can be charged separately.
Constant current	•Charging current:0.1CA •Charging time (hours)=[Amount of self-discharge (Ah)/0.1CA]× 120% •Rough estimation of amount of self-discharge is as follows (for an example): When the storage ambient temperature is lower than 25℃, and storage time is known, assume the following amount of self-discharge:[5%/month]×storage months •Multiply this by the rated capacity (at 20 hour rate) of the battery • Regardless of the above Calculation, the charge time for a refresh charge must be less than 12 hours. •When the storage ambient temperature is higher than 25℃, please consult motoma power.

4. Maintenance & Checking

4.1 Keep the terminals of the battery clean. Dirty terminals may cause inadequate contact of the battery to the equipment body, leading to power failure or charge failure.

V. Storage

1.1 During storage of the battery, charge it at least once every six months (when ambient temperature is 77℉ (25℃) or below). Shorten the interval of charging to a half by every 50℉ (10℃) rise of ambient temperature.
The rate of self discharge of the battery doubles for each 50℉ (10℃) rise of ambient temperature. If the battery has been stored for a long period in a discharged state, it may not be able to regain it's capacity even if it is recharged.

1.2 If the battery is stores for a year or longer without being charged, its service life may be shortened.

1.3 Store the battery after fully charging it, otherwise its service life may be shortened.

1.4 Use the battery as soon as possible. The battery gradually deteriorates during storage and thus its decreased capacity may be irreversible even allowing when recharged.