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INSTALLATION AND OPERATION INSTRUCTIONS

This document details procedures to be followed while installing and operating ***AMARON QUANTATM & HWS SMF-VRLA*** batteries. The procedures herein described are meant for use by the customers of Amara raja Batteries.

This document is a part of the documentation system in ***Amara raja Batteries*** Limited and the procedures described in this manual are supportive to the quality manual.

Suggestions and recommendations on this manual may please be mailed to the National Service Manager Channel Service at ***mktg@amararaja.com***.

The technical details in this manual may be changed/modified without prior notice due to design improvements as per company's continuous improvement policy.

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1 INTRODUCTION

Amara Raja Batteries Ltd, (ARBL) the largest manufacturer of stand by Valve Regulated Lead Acid (VRLA) batteries in the Indian Ocean Rim, comprising the area ranging from Africa and the Middle East to South East Asia. Our State-of-the-art manufacturing units are located at Tirupati & Chittoor with our Corporate Office in Hyderabad, India.

The production process is highly automated and microprocessor based controlled systems ensures adherence to process parameters. The products that leave the unit are thus of the highest quality possible. The company was awarded the coveted **ISO-9001** certification in 2015, **ISO 14001** re- certification in 2015, and ISO 45001: 2018 to Quality, Environment and Occupational Health and Safety Management Systems.

By employing latest generation technology and with a clear understanding of current power back up requirements, Amara Raja has become the benchmark in the manufacture of lead acid batteries for different applications. Amara Raja Industrial Batteries offers a broad range of battery solution in segments like UPS, Solar, Energy Storage Solutions (ESS), Telecom, Railways, Defence & Motive Power. Amara Raja Batteries Limited(ARBL) the first company to manufacture Valve Regulated Lead-Acid (VRLA) batteries in India. They are engineered to provide the performance reliability and consistency over the life of the product and they offer a long battery life with minimal maintenance.

2 BRIEF REVIEW OF TECHNOLOGY

The electrode reactions in all lead acid batteries are basically identical. As the battery discharges, the lead -dioxide (positive active material) and the spongy lead (negative active material), both react with the sulphuric acid (electrolyte) to form lead sulphate and water. During charge, this process is reversed.

In conventional lead acid batteries towards the end of charging, the oxygen gas gets evolved at the +ve electrode and the hydrogen gas gets evolved at the –ve electrode. These gases will bubble out through the free electrolyte media and escapes into the environment, there by water are lost from the battery. Hence periodic topping up of these batteries with DM water is required.

In VRLA Batteries, the oxygen gas generated at the +ve plate is transported in the gaseous phase through the absorbent microporous glass mat (AGM) separator to the surface of the –ve plate. The oxygen gas gets reduced by reacting with the charged active material, spongy lead, of the –ve plate. There by the evolution of hydrogen gas is effectively suppressed. Consequently, the VRLA batteries do not lose any water under normal operation and therefore, no topping up is required. This phenomenon is called the Oxygen Recombination Principle.

All VRLA cells are provided with self-resealing safety valves to release the excess gases into the atmosphere under abnormal charging conditions. Hence these batteries are named as valve regulated lead acid (VRLA) batteries.

3 MAJOR ADVANTAGES OF VRLA BATTERIES

* Supplied in factory filled, charged and ready to use condition.
* No topping up is required.
* Spill proof and leak proof
* No corrosive fumes are emitted, hence user friendly
* Safe and Explosion proof.
* Easy to install & Environment friendly.

4 GENERAL INFORMATION

4.1 AMARON QUANTATM & HWS BATTERIES

In normal use, AMARON QUANTATM & HWS Batteries will not generate or release hydrogen and oxygen gases, will not release acid mist and will not have acid leak. This is because AMARON QUANTATM & HWS Batteries are designed differently from conventional lead acid batteries in order to provide maintenance - free operation. They are inherently safer than conventional lead acid batteries. However, there is a possibility that under abnormal operating conditions, or as a result of damage, misuse and /or abuse, these potentially hazardous conditions (gassing, acid mist, and leaking electrolyte) can occur. Thus Amara Raja recommends that the instructions entitled “SAFETY PRECAUTIONS” be reviewed thoroughly and strictly followed when working with AMARON QUANTATM & HWS Batteries.

5 SAFETY PRECAUTIONS

5.1 SAFETY ALERT

The safety alert symbol at the right appears throughout this manual. Where the symbol appears, obey the safety message to avoid personal injury.

CAUTION

Before proceeding with the unpacking, handling, Installation and operation of this AMARON QUANTATM & HWS valve- regulated lead-acid storage battery, the following general information should be reviewed together with the recommended safety precautions.

5.2 SULFURIC ACID BURNS

DANGER
SULFURIC ACID BURNS

Batteries contain sulfuric acid, which can cause burns and other serious injuries. In the event of contact with sulfuric acid, flush immediately and thoroughly with water.

Secure medical attention immediately. When working with batteries, wear a rubber apron, rubber gloves and safety goggles or other eye protecting equipment. These will help in preventing injury of contact is made with the acid.

5.3 EXPLOSIVE GASES

DANGER
EXPLOSIVE GASES

Under abnormal usage and excessive overcharging batteries can generate excessive gases, which will be released pressure through the vent plugs / safety valves area and any

contact with spark/fire will lead to excessive flames causing blindness and other serious injury. If the safety vent opens while the gases are being generate (i.e. in the event of the charger malfunction / over charge) these explosive gases will be released. Keep sparks flame and smoking materials away from the batteries area.

5.4 ELECTRICAL SHOCK AND BURNS

DANGER
ELECTRIC SHOCK

All installation tools should be adequately insulated / covered with vinyl electrical tape, or suitable non-conducting material to minimize possibility of shorting across connections.

Never lay tools or other metallic objects on modules as it may result in shorting of battery leading to explosions and personal injury.

Multi-battery systems attain high voltages therefore extreme caution must be exercised during installation of a battery system to prevent serious electrical burns or shock. Loose or dirty connectors / connection can cause battery fires. Keep all connectors / connections clean and torque at proper values. Keep the outside of batteries clean and dry Neutralize any acid corrosion with cloth moisture with a solution of baking soda and water, then wipe off all traces of soda.

Do not move or shift the cabinet once installed without first disconnecting load to the cabinet and all inter cabinet connections. Refer wiring diagrams for location of these connections.
Do not lift the Batteries by terminals / posts. Do not tamper with post seals, protective covers pressure relief vents or other battery components. Disconnect the DC circuits from the charging equipment & load before working on batteries. Ensure that the personnel who stand the risk of working with batteries are prepared and equipped to take the necessary safety precautions. These installations and operating instructions should be understood and followed. Assure that you have the necessary equipment for the work, including insulated tools, rubber gloves, rubber aprons, safety goggles and face protectors.

CAUTION

If the foregoing precautions are not fully understood, clarification should be obtained from your nearest Amara Raja representative.

5.5 IMPORTANT MESSAGE

The symbol at the left indicates an important message. If not followed, damage to and / or impaired performance of the battery may result.

6 RECEIPT OF SHIPMENT

6.1 DELIVERY INSPECTION

Upon receipt of shipment unload and store the batteries in covered area. Do not expose them to direct sun light, rain, dust, storm, etc. Immediately upon delivery, examine for possible damage caused in transit, damaged packing material could indicate rough handling. Make a descriptive note on the delivery receipt before signing. If battery damage is found, request an inspection by the carrier and file a damage claim immediately. Any battery with post or seal damage should be replaced.

6.2 CONCEALED DAMAGE

Immediately upon receipt of shipment examine all the batteries and cabinets for concealed damage. If damage is noticed, immediately request an inspection by the carrier and file a concealed damage claim. Any delay in notifying carrier may result in loss or no right to reimbursement for damages.

7 STORAGE PRIOR TO INSTALLATION

7.1 STORAGE LOCATION

Do not locate batteries in places exposed to direct sun light, rain dust, storm etc. Such exposure will cause damage to plastic components and will reduce battery life drastically.

If the battery is not to be installed at the time of receipt, it is recommended that it to be stored indoors at a temperature of 15°C - 32° C, clean, dry location provided with a freshening charge interval detailed in Section 7.1. Do not stack wooden crates or cases one above the other to prevent damage to the batteries.

7.2 STORAGE INTERVAL

AMARON QUANTATM & HWS batteries have a long shelf life provided that the following instructions are adhered to. During the storage interval (i.e. between date of shipment and date of installation) a freshening charge should be given as per below table.

Storage at elevated temperatures will result in accelerated rates of self-discharges. The table given below shows the storage interval at the various elevated temperatures before which a freshening charge is to be given.

Charging Average Ambient Temp0c	Interval (Months)	Recommended Freshening Charge Voltage & Duration	
		Charging Voltage – Volts	Duration(hrs) when charged with current limit of 25% of Ah capacity @C20 rate
<27	06	For Single Module at 27°C	
27-32	4.5	13.8V - Boost	16 to 24 Hrs
32-37	03		
37-42	2.25		
42-47	1.5		

Storage beyond these periods without charge can result in excessive sulphation of plates, which is detrimental to battery performance and life. Instruction on how to apply a freshening charge are detailed in 11.0.

Important Note: Wherever charging current is referred in this manual, the following tabular charging current values to be consider for corresponding HWS models.

Model Number	Min. Charging current	Max. Charging current
12HWS-388W	12Amps	24Amps
12HWS-440W	14.4Amps	36Amps
12HWS-540W	18Amps	45Amps
12HWS-730W	24Amps	60Amps

Charging Mode: Constant Potential with current limit.

Note: The charger/UPS should have protection against over charge and discharge beyond prescribed end voltages. Deep discharges can cause permanent damage to the battery. It is recommended that interconnecting cable between battery and load shall be selected to ensure a maximum drop of 30mV per meter length at the maximum rate of discharge. All temperatures given in this Section should be considered as average temperatures for the entire duration of the storage interval.

7.3 BATTERY CONTAINER & COVER

The batteries are uniquely made of using PPCP/FRPPCP material which will well suits for Tropical environment due to its properties such as lower water permeability characteristics. This will help us in not losing higher moisture from the batteries during its service when operating at tropical

environments unlike other plastics such as ABS. Since the VRLA batteries works under positive pressure to support superior oxygen recombination in the battery, PPCP which is elastic in nature has bulging as a normal property. This Elongation is due to material characteristics and it will not have any adverse effects on battery performance when operated at normal conditions as recommended by the manufacturers.

8 GENERAL INSTALLATION CONSIDERATION

Prior to installation of the AMARON QUANTATM & HWS battery system, a review of this section is strongly recommended

8.1 BATTERY LOCATION

It is recommended that the battery unit be installed in a clean, cool & dry location. Floor should be reasonably level and able to support the battery weight. A location is having an ambient temperature of 27°C will result in optimum battery life and performance. Average ambient temperatures above 30°C will result in reduction of battery life. Continuous operation above 50°C is not recommended.

DO NOT INSTALL BATTERIES IN LOCATIONS WITHOUT ANY VENTILATION. When selecting the location for installation of the battery, certain consideration must be followed. First, a designated aisle space should be provided to permit initial installations as well as for service and surveillance. After installation, any additional equipment installed should not compromise access to the battery system.

8.2 VENTILATION

The AMARON QUANTATM & HWS battery is a valve-regulated lead-acid battery, which is under normal recommended charging, in a stationary application, does not vent any gases. Tests have confirmed that more than 98% of gases generated are recombined within the battery. Under normal operating conditions, no special ventilation and / or battery room is required

NEVER INSTALL BATTERIES IN AIR TIGHT ENCLOSURES. This is because, under abnormal operating conditions like misuse/malfunction of charger etc. there is a possibility that the battery gets excessively overcharged. When this happen the hazardous gases, hydrogen and oxygen are released from the battery and can cause water loss. Therefore, ensure proper ventilation is provided. Normal ventilation, sufficient for human occupation, is adequate to avoid hazardous conditions.

AMARON QUANTATM & HWS batteries can be installed in close proximity to electronic equipment provided that the heat generated by the electronic equipment is removed by ventilation..

8.3 TEMPERATURE VARIATIONS

Sources of heat or cold directed on portions of the battery can cause temperature variations within the strings resulting in cell voltage differences and eventual compromise on battery performance. Heat sources, such as heaters, sunlight or associated equipment can cause such temperature variations. Similarly, air conditioning or outside air vents should not directly influence portions of cell string temperatures. Every effort should be made to keep temperature variations to a minimum.

Average Ambient Temperature° C	Voltage Settings Volts Per Module (VPM)	
	Float	Boost
27° C	13.50 VPM	13.80 VPM

8.4 FLOOR LOADING

The floor of the area where the battery system is to be installed should have the capability to support the weight of the battery system, as well as any auxiliary equipment. The total battery weight will depend on the battery size, number of modules, as well as module configuration involved. Prior to installation, a determination should be made that the floor integrity is adequate to accommodate the battery system.

8.5 FLOOR ANCHORING

Where seismic conditions are anticipated, floor anchoring should be provided. Such anchoring is responsibility of the end user.

9 CABINET SYSTEM - INSTALLATION

9.1 CABINET ASSEMBLY INSTRUCTIONS

Check parts received against the packing note. Contact your local Amara Raja representative if parts appear incomplete. Identify missing parts by part number and parts description.

Do not assemble if all material is not at the installation site or parts do not comply with drawing.

Study the battery arrangement drawing for cabinet / rack assembly, then start assembly of parts like frames, tiers, module restraint plates etc.

9.2 PLACEMENT OF BATTERIES

Study the battery arrangement drawing to determine the proper location of the positive and negative terminals of the battery and to determine the correct placement of the batteries in the cabinet. From the battery arrangement drawing determine the number of batteries to be placed in each row and tier. When installing modules in the cabinet, start on the back row of the lower tier for stability and safety reasons. Place modules in cabinet so that the positive (+) of one unit connected to the negative (–) of the next unit in accordance with the battery arrangement drawings. Standard spacing is 5 mm between modules. Ensure that the Batteries to be installed always in vertical position only.

10 ELECTRICAL INSTALLATION CONSIDERATIONS

10.1 CONNECTING CABLES

Cable size selection should provide the lowest voltage drop possible between the battery system and operating equipment. Excessive voltage drop will reduce the desired support time of the battery system. The maximum voltage drops in the cable between the system and operating equipment should not be more than 0.03V per meter length.

10.2 PARALLELING

Where it is necessary to connect battery in parallel to obtain Sufficient capacity, cable connections from the bus / load to each of the parallel strings is preferred rather than inter-string paralleling. Cables should be sized to minimize voltage drop and for proper current carrying capability. They should be as short as possible. However, the lengths of cables for all of the systems being paralleled to the load should be equal in length and size to provide proper load sharing on discharge, as well as satisfactory

recharge with the same float voltage per string. Care should be taken to ensure overall resistance of connection between batteries and equipment - bus are consistent between strings.

10.3 CONNECTION PREPARATION

Gently clean the contact surfaces only by using the brass brush / emery paper.

For mounting batteries into the cabinet refer to the battery arrangement drawings to determine the quantity and correct positioning of the inter-unit and inter-tier connections.

Caution: Do not use wire brushes of any other type for contact surface cleaning.

10.4 CONNECTION TORQUE

After preparing contact surfaces, install all connectors. Hand tight to allow for final alignment of modules. Once final alignment is made all connections with hardware should be torque as per below table and complete all the connection of modules by installing the inter-tier & module connections. Recommended Terminal Torque for tightening is given in below table

Terminal Type	Recommended Terminal Torque
M5	7-8N-m (or) 62-71 Lb-inch
M6	11N-m (or) 100 Lb-inch
M8	13N- m (or) 115 Lb-inch

Caution: Do not make connections to the load at this time.

10.5 CONNECTIONS

10.5.1 GENERAL

Battery terminal and inter-battery connections should be corrosion free and tight for trouble-free operation. Periodically these connections should be inspected to assure cleanliness and integrity.

Caution: Do not work on connectors with battery connected to charger or load.

If corrosion is present, disconnect the connector from the terminal. Gently clean the affected area using a brass brush or emery paper and follow all directions as specified in section 10.2 and 10.3

All terminals and inter-battery connections should be re-torqueing at least once in every six months. It is recommended to keep one inter tire connector unconnected before connecting the end connections. After connecting the charger/end connection inter tire connection can be made.

10.5.2 CONNECTIONS CHECK

Visually check to see that all modules are connected positive (+) to negative (–) throughout the battery string. Measure the total open circuit voltage from positive string termination to negative string termination and also record the individual module voltages. For the fully charged battery, the voltage should be greater than 12.90 Volts

If the value for a battery is less than 12.60 Volts, contact your nearest Amara Raja representative.

The bank voltage shall be equal to the sum of individual battery voltage.

10.6 BATTERY TO UPS - CHARGER CONNECTION

The Positive (+) terminal of the battery should be connected to the positive (+) terminal of the UPS charger and the negative (–) terminal of the battery to the negative (–) terminal of the UPS charger.

11 FRESHENING CHARGE

11.1 CONSTANT VOLTAGE METHOD

Batteries lose some capacity during shipment as well as during the period prior to installation. A Battery should be given a freshening charge prior to installation.

Constant voltage is the only charging method allowed. Most of the modern UPS chargers are of the constant voltage type.

Freshening charge of the batteries should be done in the Boost Charge mode for 24 hrs. with a current limited to maximum of 25% of the rated capacity, selecting a charging voltage of 2.3V multiplied by number of cells i.e. 13.8V for 12V module.

The maximum charging current under normal operation should be limited to 25% of the rated capacity of the battery at the C20 rate (for an 100 Ah battery @ 20 Hr rate, the maximum charging current should be 25A). The duration of charge should be twenty-four (24) hours.

12 OPERATION

12.1 FLOAT CHARGE

In this type of operation, the battery is connected in parallel with a constant voltage charger and the critical load circuits. The charger should be capable of maintaining the required constant voltage at the battery terminals and also of supplying the normal load where applicable. This sustains the battery in a fully charged condition and also makes it available to resume the emergency power requirements in the event of an AC Power interruption or charger failure.

12.2 FLOAT AND BOOST VOLTAGES

Following are the Float and Boost Voltages recommended for the AMARON QUANTATM & HWS Battery system. However in both the float and boost voltage the max charging current is limited to 25% of the battery capacity.

Mode	Recommended voltage settings for float cum boost charging @27°C	Current Limit set (AMP)
Status	Single Module	
Float Boost	13.5V 13.8 V	25% of battery Ah capacity

Following recommended surveillance procedures will assist in obtaining consistent service ability and optimum life. After the battery has been given a freshening charge, the charger should be adjusted to provide the recommended float voltage at the Battery Terminals.

Do not float batteries at voltages higher or lower than those recommended which will be resulted reduced capacity or loss of battery life.

After completion of the freshening charge as given in freshening charge section the minimum open circuit voltage should be as per below

Model	Voltage
12 Volt Configuration	13.2-V

12.3 RECHARGE

All batteries should be recharged as soon as possible, following a discharge, with constant voltage chargers. However, to charge in the shortest period of time, raise the charger output voltage to boost mode, i.e. 2.3 VPC. The charger used should incorporate a current limit feature. The maximum recommended charge current for the AMARON QUANTATM & HWS battery is limited to 25% of the rated capacity of the battery at the C20 rate, for HWS refer the charging current given in cl 7.1 of storage period.

Time required to reach 100% SOC	Charging Voltage	Current Limit
24 hrs - 36 hrs	2.30VPC/13.8VPM	10%
16 hrs - 24 hrs	2.30VPC/13.8VPM	25%

12.4 TEST DISCHARGE

The batteries are shipped at 90-95% of the rated capacity, the same will be delivered 100% capacity after few charge / discharge cycles @ C20 capacity or 6 months in continuous float service for HWS batteries the discharge is as applicable based on battery sizing calculations or C15mins wattage discharge or 6months in continuous float service. However, the boost charge is mandatory for 24 – 36 hours with minimum 10% current limit of the rated Ah capacity prior to conduct the capacity test at field.

User may follow the above table to achieve the optimum performance the battery.

13 EQUALIZATION

13.1 EQUALIZING CHARGE

Under normal operating conditions, an equalizing charge is not required. An equalizing charge is a special charge given to a battery when non-uniformity in voltage has developed between modules. It is given to restore all modules to a fully charged condition. Use a charging voltage higher than the normal float voltage i.e., 13.8 VPM for a maximum period of 24 hours.

Non-uniformity of battery voltages may result from low/high float voltage due to improper adjustment of the charger or error in panel voltmeter which leads to an incorrect lower/higher charging voltage.

EQUALIZING FREQUENCY

An equalizing charge should be given when the following conditions exist:

- Once in every six months or when the float voltage of any module in strings is less than 13.20 V.
- Recharge of the battery is required in a minimum time following an emergency discharge.

14 SYSTEM MONITORING

14.1 INSPECTION AND MONITORING CHART FOR VRLA BATTERIES UNDER OPERATION:

Description	Monthly	Qtly.	Hly.	Yearly
Check the float charging voltage and current. (Voltage: 13.38 volts per cell, Current: min 10% to max 25% of the module rated capacity)	✓			
Note down the average ambient Battery room temperature. (Battery will give optimum performance when operated @ 27°C.)	✓			
Check the charger ripple and the regulation. (Ripple: <2% rms. Value, Regulation: ± 1 %.)		✓		
Check the over voltage cut off and under voltage trip. (Over voltage cut-off : 13.98VPM,Under Voltage trip:10.5VPM)		✓		
Boost charge the batteries for 24 Hrs. (Voltage: 13.80VPM, Current: 25 % (max) of cell rated capacity).		✓		
Note down individual cell voltage readings after discharging the battery bank for 15 min with current limit min 10% to max 25% of the rated capacity to identify the weak cells if any.		✓		

Description	Monthly	Qtly.	Hly.	Yearly
Inspect for any Physical damages, Heat seal leakage, Cracks on cover & container. (1st time before installation & quarterly afterwards)		✓		
11Nm for M6 and 13Nm for M8 terminal.			✓	
Do the discharge at to understand the battery capcity (C20hrs/for HWS at C15mins/ as applicable)				✓

Note: Maintain Battery records without fail(Charge/discharge readings)

*If terminal bolts are not tightened properly, terminal/terminal post may lead to overheat or melt.

14.2 PROCEDURE FOR RECOUPMENT OF THE CAPACITY LOST DURING STORAGE

The batteries are shipped at 90-95% of the rated capacity, the same will be delivered 100% capacity after few charge / discharge cycles @ C20 capacity or 6 months in continuous float service for HWS batteries the discharge is as applicable based on battery sizing calculations or C15mins wattage discharge or 6months in continuous float service. However, the boost charge is mandatory for 24 – 36 hours with minimum 10% current limit of the rated Ah capacity prior to conduct the capacity test at field.

User may follow the above table to achieve the optimum performance the battery.

- Carry out the High rate Discharge test on all the cells to 1 Volts (Preferably C3 or C5 current rate).
- Change the cell at 2% current of its capacity for a duration of 60 hrs.
- Give a minimum of 3Hrs and a maximum of 12 hrs rest.
- Then discharge the cells at C20 rate.

If rated capacity of the module is not obtained during the first cycle, repeat the above points 2 to 4 two more times. If problem persists send the details to nearest Amara Raja Office for guidance.

14.3 ASCERTAINING THE STATE OF CHARGE OF VRLA BATTERIES

Generally, towards the end of charging the current drawn by the battery will get reduced and stabilized at lower level. If the current drawn by the battery towards end of charging is constant for 3 consecutive hrs, then it indicates that the battery has almost reached to its full state of charge. The approximate state of charge of the battery, to some extent can be determined by the amount of charging current going to the battery. While charging the current shown by the charger ammeter will be combination of load current plus the current necessary to charge the battery. The current to the battery will start to decrease and will finally stabilize when the battery becomes fully charged. If the normal connected load is constant (no emergency load connected) the state when the current level remains constant, after it has started decreasing, for three consecutive hours we would indicate fully charged condition and the battery will be ready for normal use.

The state when the voltage across the battery terminals is stable for 6 consecutive hours would indicate fully charged condition and the battery is ready for normal use. The OCV under different state of charge are shown in table–A.

% State of Charge	Open Circuit Voltage +0.05 -0.02
100	12.90
90	12.78
80	12.66
70	12.54
60	12.42
50	12.30

15 PILOT MODULE AND RECORDS

A pilot unit is selected in the series to reflect the general condition of all modules in the battery string. By measuring module voltage, it serves as an indicator of battery condition between scheduled overall individual module readings.

Complete recorded history of the battery operation is most desirable, and is helpful for maintaining satisfactory performance. Good records will also indicate when corrective action may be required to eliminate problems associated with charging, maintenance and environment the connections.

The following data should be read and permanently recorded for review, by supervisory personnel.

A) Upon completion of freshening charge and with the battery on float charge at the proper voltage for one week, read and record the following:

1. Individual battery voltages
2. Battery string terminal voltage
3. Ambient temperature

B) Every 12 months, a complete set of readings, as specified in paragraph A above must be taken and all individual battery to be re-torque.

C) Whenever the battery is given an equalizing charge, additional set of readings should be taken and recorded, as specified in paragraph A above.

Records must be prepared as specified in this Section in order to maintain the validity of the Warranty. For system protection and to suit local conditions or requirements, more frequent readings are desirable.

16 TAP CONNECTIONS

Tap connections should not be used on a battery. This can cause over-charging of the unused batteries and undercharging of those batteries supplying at load thus reducing battery life.

If these instructions are not adhered to and any damage is caused to the batteries as a result of tap connections, the warranty issued at the time of supply of the battery will be treated as null and void.

17 TEMPORARY NON-USE

An installed battery that is expected to stand idle for over 6 months should be treated as follows:

A) Give the battery an equalizing charge. Following the equalizing charge, open the connections at the battery terminals to remove charger and load from the battery.

B) Every six months temporarily connect battery to charger and given an equalizing charge.

C) To return the battery to normal service, re-torque all connections as per section 7.3 and then re-connect the battery to the charger and return the battery to float operation.

D) If the battery is standing at an elevated temperature, corrections to the time period to equalize charge should be corrected as section 4.1

18 DO'S AND DON'TS

DO's

- Upon receipt of shipment unload and store the batteries in covered area.
- Read 'Installation and operating "instruction Manual" prior to installation of the batteries.
- Clean the batteries as and when dust accumulates.
- Provide sufficient ventilation, if the batteries are placed in cubicle.
- The terminal bolt connection to be torque to 7-8N-m (or) 62-71 Lb-inch,
- 11 Nm (100 lb. Inch) for M6 terminal and 13 Nm (115 lb. Inch) for M8 Terminal.
- Re-torque the connections once in every six months.
- Keep the batteries away from heat source, sparks, fire etc.
- Charge the batteries once in every six months, if stored for long periods.
- After a discharge recharge the batteries immediately.
- Note down module voltage readings once in every month.

DONT's

- Do not keep the batteries in places exposed to direct sunlight, rain, dust, storm etc.
- Do not add water or acid.
- Do not attempt to dismantle the battery.
- Do not over tighten the terminal bolts.
- Do not allow any metal objects to rest on the battery or fall across the battery terminals.
- Do not boost charge the batteries for more than 12 hrs. In regular operation / usage.
- Do not mix the batteries of different capacities or makes.
- Do not mix ordinary conventional / low maintenance batteries with
- AMARON QUANTATM & HWS SMF Batteries.

19 UNIT CLEANING

Periodically clean the battery covers to remove accumulated dust. If any unit or parts appear to be damp with electrolyte, or shows signs of corrosion, clean with a solution of backing soda and water, and re-examine within 14 days to determine if condition re-occurs. If so, contact your nearest Amara Raja representative.

CAUTION

Do not clean plastic parts with solvents, detergents, mineral spirits, or spray type cleaners as these may cause crazing of the plastic materials.

20 TROUBLE SHOOTING

Symptom	Check for	Cause	Remedy
Low back up	• Charger settings • Terminal tightness • State of charge	• Lower setting • Continuous charging at high voltages • Loose contact • Not fully charged	• Re-adjust to 13.5V per Module • Replace the battery • Tighten to 11 N-m for M6 terminal and 13 Nm (115 lb. Inch) for M8 • Terminal. Charge the battery at 13.8 VPM for 24 Hrs.
Unequal voltages among the batteries	• Terminal tightness • External heat sources directed on few batteries • Tap connections • Boost charge	• Loose in few modules • External heat sources direct on few batteries • Tap connections • No boost charge once in three months	• Check the terminals tightness for all the batteries. Tighten to 7-8Nm for M5 terminal, 11Nm for • M6 terminal and 13 Nm for M8 Terminal. • Redirect the heat sources from the batteries/ reposition the batteries. • Remove the tap connections • Boost charge at 13.8 VPM for 24 Hrs.

Symptom	Check for	Cause	Remedy
Abnormal battery heating	• Ventilation • Ripple • Charger setting	• Poor • Very high ripple in the charger output. • Continuous over charge	• Provide adequate ventilation. • Rectify the charger • Replace the battery

BATTERY MONITORING REPORT

Date:

Company _____

Address _____

No. of Modules _____

Serial No. _____

Date Installed _____

Model. No. of battery _____

_____

Operating Parameters

Date: Time:

Charger Output (at UPS terminals) _____

Ambient Temp _____

Total Battery bank Voltage (at battery bank terminals) _____

Panel Meter Volts _____

Charging Current (at the time of reading) _____

INDIVIDUAL UNIT READINGS

Unit No.	Volt	Unit No.	Volt
1		26	
2		27	
3		28	
4		29	
5		30	
6		31	
7		32	
8		33	
9		34	
10		35	
11		36	
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Remarks and Recommendations _____

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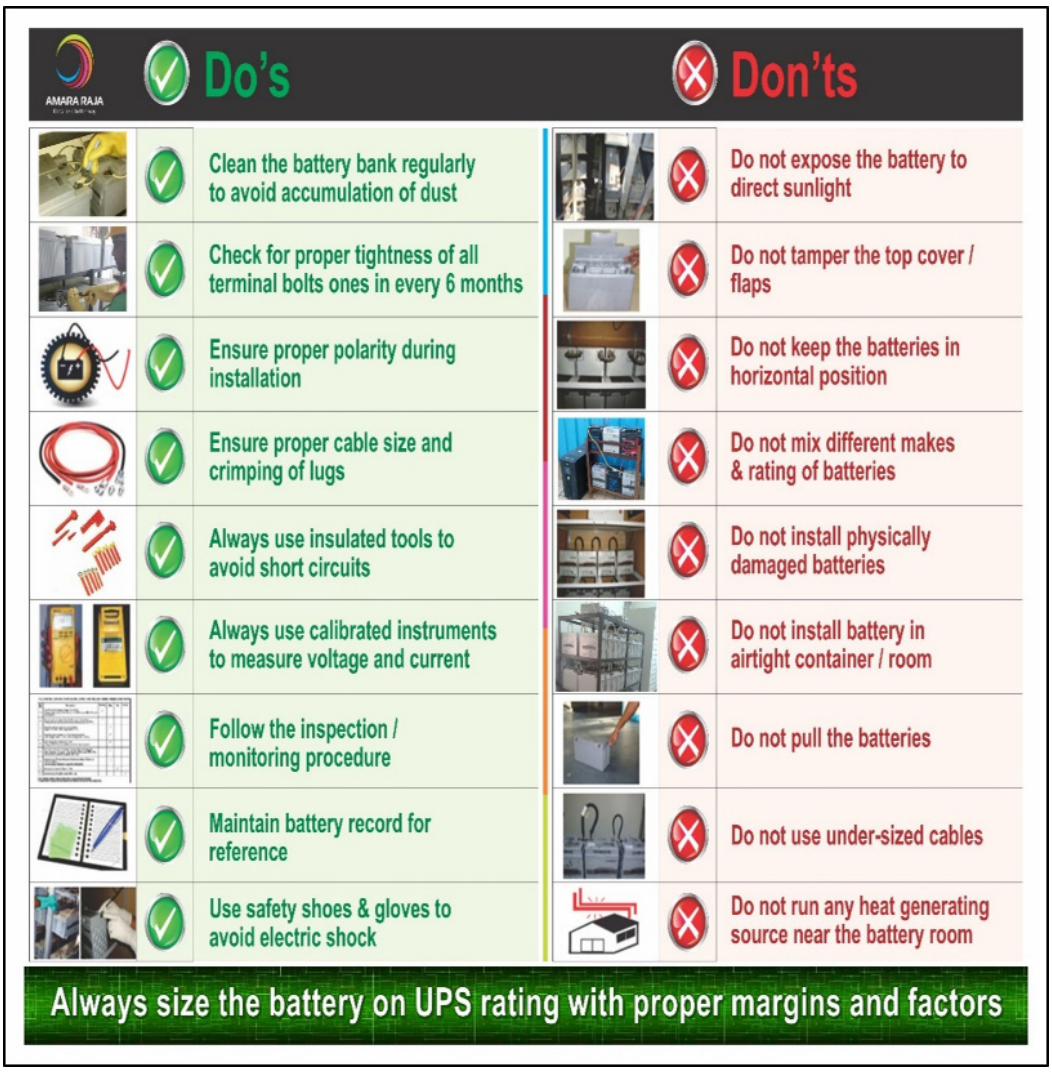
READINGS TAKEN BY _____

When advice is desired, please forward a duplicate of this report to your nearest Amara Raja representative.

Note: - Use copies of monitoring format, if required.

Risk of fire, explosion, or burns. Do not disassemble, heat above 55°C or incinerate.

Recommend to put up the below Do's & Don'ts Posters in all battery rooms for better maintenance and monitoring purpose



AMARARAJA SERVICE NET WORK

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