Wing ES Range

STATIONARY 6/12 Volt BATTERIES

INSTALLATION and OPERATING INSTRUCTIONS

TABLE OF CONTENTS

SECTION 1 - GENERAL INFORMATION

1.1 ***Wing 6/12 Volt*** *Battery Characteristics*

The ***Wing 6/12 Volt*** Monobloc *battery is a valve-regulated lead-acid recombinant battery designed for stationary applications. This type of battery has no special ventilation or handling requirements. Because the electrolyte in the battery is immobilized, the batteries are considered dry batteries and can be handled and shipped accordingly.*

SECTION 2 - SAFETY INFORMATION

2.1 *General Information*

Lead acid batteries require care in installation and maintenance. Unsafe installation or maintenance procedures can cause severe injury or death. Electrical shock or burns, acid burns and fire can result if proper safety precautions are not followed.

The following precautions apply to all battery installation and maintenance work. For more information, see the following Sections.

- *Disconnect all power before attempting to install, remove or perform maintenance work. When on-charge float voltages must be measured, be particularly careful because shorting a battery at this time can cause not only personal injury, but severe equipment failure as well.*
- *Do not tamper with any parts of the battery including cover, vents, terminal covers, etc.*
- *Keep batteries clean and dry. Use ½ kg of baking soda in 4 liter's of water to neutralize any acid. Do not use cleaners or solvents on any part of the battery. Do not allow excessive dust to accumulate on the battery or cabling.*
- *Keep battery connectors clean, greased and tight. A loose connection can reduce battery standby time and cause battery fires.*

2.2 *Sulphuric Acid*

The ***Wing 6/12 Volt*** Monobloc *is a lead acid battery and contains Sulphuric acid in diluted form. Because the electrolyte is immobilized, in the event of case rupture, no liquid acid will leak or run from the battery. However, if the internal components of the battery are touched or handled, contact with the acid will result.*

CAUTION: Sulphuric acid can cause burns and serious injury if it comes in contact with your skin or eyes. In the event of contact with Sulphuric acid, flush thoroughly with water and neutralize any residual acid with baking soda (1kg in 4 liter's of water). Seek medical attention immediately. Do not handle batteries that have been dropped or where the container has been ruptured except while wearing rubber gloves. Do not try to disassemble a battery.

2.3 *Gassing*

All lead acid batteries emit some gases during charging and float operation. Conventional flooded

batteries release all the gases produced to the environment whereas valve-regulated batteries re-combine most of the gases internally, releasing very little to the environment. Compared to a flooded battery of equal capacity, a ***WingE 6/12 Volt*** Monobloc *battery releases a gas volume of 1% or less than the flooded battery. Because of this characteristic, no special ventilation is required under normal usage conditions.*

Because some gas is released from lead acid batteries, never charge or use batteries in an unventilated space or container. This gas consists of mostly hydrogen gas and can explode if ignited in a confined area or space. Keep sparks, flame, or any other ignition source (including smoking materials) away from batteries.

CAUTION: Hydrogen gas can explode and cause serious injuries and fire. Do not allow any flame or ignition source near batteries. Always allow some ventilation around operating batteries; contact Wetac if there are any questions regarding gassing or ventilation.

2.4 *Electrical Shock*

Batteries store large amounts of electrical energy. Even a discharged battery can deliver a high short circuit current. Keep all metallic objects away from the battery terminals. Multi-cell systems can attain lethal voltages. Remove all jewelry before working on batteries. Cover all tools with vinyl electrical tape to minimize the possibility of shorting a battery during installation. Never lay tools or other metallic objects on batteries. Do not allow construction work over batteries to proceed unless the battery is protected by insulating rubber mats.

CAUTION: Shorting a battery can cause serious injury, fire or explosion. Do not attempt to work on a battery unless you are familiar with battery installation procedures and have adequate safety information and equipment. Read this manual thoroughly before attempting to install the battery. If there are any questions about safety, contact Wetac before installing the batteries.
SAFETY is always the primary concern.

SECTION 3 - RECEIPT OF EQUIPMENT

3.1 *Delivery Inspection*

Immediately upon delivery, inspect the batteries for damage caused in transit. Damaged pallets or packing material or disarrayed batteries could indicate rough, improper handling in transit. Describe in detail (and take photographs if necessary) any damage on the delivery receipt before signature. If any damage is found, contact the carrier immediately, request an inspection, and file damage claim.

3.2 *Hidden Damage*

Within 10 days of receipt, inspect all batteries for hidden damage. Measure and record open circuit voltages (OCV's). If any damage is found, request an inspection by the carrier and file a hidden damage claim. Do not delay this step as it may result in a loss of right of reimbursement for hidden damages.

SECTION 4 - STORAGE

4.1 *General*

Do not store batteries outside, exposed to the elements. Store indoors in a cool, dry location. Do not store batteries in temperatures over 35ºC. The recommended storage temperature is 20ºC or less. Do not stack pallets or allow any other material to be stored on top of the pallets or possible battery damage may occur. Do not store where the possibility of metallic objects falling on the battery may occur.

4.2 Short Term Storage

If the batteries are to be stored for 6 months or less at 20ºC, before being put into service, nothing need be done at this time. If the batteries are to be stored for longer than 6 months, at temperatures greater than 20ºC, or installation is delayed beyond expected time, a storage charge may be required. A storage charge is an equalization charge applied to a battery that is stored in open circuit (not float charging) condition. See Section 6.5 for details.

If the storage temperature is 20ºC or less, ***Wing 6/12 Volt*** Monobloc *batteries must be charged at least every 6 months while in storage. For every 8ºC increase above 20ºC, the storage time between charges is cut in half. Therefore at 28ºC the maximum storage time is 3 months. At 25ºC the maximum storage time would be 4-5 months..*

Storage of batteries beyond the recommended temperatures or storage time, without charging, can result in loss of capacity, cell shorting and loss of float life. It can also void the battery's warranty. Keep careful records of battery storage time and handling.

SECTION 5 GENERAL INSTALLATION PROCEDURES

CAUTION: Before attempting to install Wing 6/12 Volt* Monobloc *batteries study this Section and the Section on safety thoroughly. Failure to do so could result in personal injury and battery or equipment damage.

5.1 Battery Location

5.1.1 Temperature

Battery location is very important in determining life and performance of the battery. The ideal environment would be a dry, indoors, temperature regulated area. The ideal operational temperature is 20ºC. Operation at temperatures below this will result in reduced battery performance and may result in a larger, more costly battery being needed. Operation at temperatures above 20ºC will result in reduced operation life. For every 8ºC rise in battery temperature above 20 ºC, the life of the battery will be cut in half. For example, the ***Win 6/12 Volt*** Monobloc *battery is designed for a 12 year float service life at 20ºC. If the battery were to be continuously operated at 28ºC, the life expectancy would be halved.*

5.1.2 Temperature Variation

Maintaining temperature balance across the string is very important for maximum battery life. The difference between the maximum and minimum monoblock temperature in a series string can be no more than 3ºC. Excessive temperature variation will result in the need for equalization and will shorten battery life.

Sources of battery temperature variation can be placement of the battery system near a heat source such as radiators, power equipment, windows or heating vents. Air conditioning vents can also cause temperature variations. It is recommended that the battery location be designed, engineered and monitored to minimize temperature variations.

5.1.3 Ventilation

Proper ventilation of ***Wing 6/12 Volt*** Monobloc *batteries is important for two reasons :*

(1) to minimize battery temperature variations and

(2) to minimize build up of potentially explosive hydrogen gas.

5.1.3.1 Ventilation & Battery Temperature Variation

Recombinant batteries such as ***Wing 6/12 Volt*** Monobloc *batteries, give off a small amount of heat during charging and float operations. Proper ventilation is important to remove this heat and to prevent temperature differences from arising in the string. If the batteries are installed in a cabinet, it should be designed to allow unobstructed air circulation and prevent temperature build-up. Use angle iron support rails instead of shelves. If the batteries are on racks, sufficient air circulation should be present to prevent temperature-layering effects. In an improperly designed room, there can easily be a 5ºC difference in temperature between the floor and the ceiling. If this difference exists in a series string, it will result in a need for equalization and in reduced battery life.*

5.1.3.2 Ventilation and Gassing

As noted, lead acid batteries emit small amounts of gas during normal charging and floating. The gas composition while on float is approximately 80% by volume hydrogen with the remainder being oxygen.

CAUTION: Hydrogen gas can be explosive. Never install batteries in an airtight enclosure. Ventilation must be provided to remove this hydrogen gas. Allow about 1 litre per hour per battery of air exchange to prevent hydrogen accumulation.

NOTE: In most cases, the amount of air circulation required for battery cooling and temperature variation maintenance will far exceed the amount of air circulation required to prevent gas build-up. However, ensure some air exchange is present in the ventilation.

5.1.4 Floor Loading

Before installing the batteries, it should be ascertained that the floor has the capability to support the weight of the battery, rack or cabinet and related equipment. The total system weight will be the sum of the batteries, rack or cabinet plus 5% for the battery connectors. It is the responsibility of the installer to ensure adequate floor load carrying capabilities.

5.2 *Seismic Considerations.*

Wing 6/12 Volt Monobloc *batteries are capable of with standing seismic events of UBC Zone 4 magnitude when properly installed in a suitably designed cabinet or rack. When seismic capability is desired, suitable floor anchoring should be provided. Proper floor anchoring is the responsibility of the installer.*

5.3 *Installation - Cabinets*

*When installing **Wing 6/12 Volt*** Monobloc *batteries in cabinets, follow the recommendations of Section 5.1.3.1 regarding cabinet ventilation. Ensure that the batteries are electrically insulated from the cabinet frame. Standard battery spacing is 12 mm minimum between battery blocks. If the cabinets are to be seismic rated, the batteries must be firmly strapped or otherwise attached to the cabinet to prevent battery shifting during a seismic event. Proper installation is the responsibility of the installer.*

5.4 *Installation - Racks.*

5.4.1 *Existing Racks*

*When **Wing 6/12 Volt*** Monobloc *batteries are to be installed on existing racks, ensure that the racks are:*

1. *of proper size for the intended battery;*
2. *have sufficient weight carrying capability for the intended battery, including seismic considerations, and of sufficient size to hold the number of blocks (plus the 12 mm needed between blocks) for the complete system.*

Before the new batteries are installed, touch up any nicks, scratches or acid marks on the rack with the paint provided by the manufacturer. Ensure that the rail insulators are in good condition or replace. Check that the rack is level and re-level if necessary. Check the floor anchors and re torque all bolts of the rack to manufacturer's specifications.

5.4.2 *New Racks*

Assemble the rack according to the manufacturer's instructions. Ensure that the rack is level and all bolts are properly torqued.

5.4.3 *Installation*

Determine the location of the positive and negative terminals of the battery with respect to the rack location. When placing batteries on the rack, alternate the polarities for proper intercell connection. Standard spacing between blocks is 12 mm. Gently position the batteries on the rack. **Do not drop.**

5.5 *Electrical Connections*

Proper battery electrical connections are very important for the best battery performance and utility. Improper battery connections can cause a loss of standby time or even a battery fire. Follow the electrical connection instructions carefully and review Section 2.4 thoroughly before working on the battery.

CAUTION: Remove all rings and watches before installing the connectors on the batteries. Ensure that all tools are insulated with vinyl electrical tape to prevent shorting. Do not reach or lean across batteries on step racks. Remember, hazardous voltages are present. Be aware of what you are touching at all times.

5.5.1 *Battery ratings are specified at the terminals of the battery. The cabling used to connect the battery terminals to the load has a voltage drop (when the battery is discharging) that is dependent on cable length and conductor size. The longer the cable run, the greater the voltage drop. The smaller the cable wire diameter, the greater the voltage drop. Therefore, to get the best performance from the battery, short, heavy cables are recommended. Do not size the cables based on current carrying capacity only. A general rule of thumb is to allow no more than a 30 mV of voltage drop per meter of cable run. As an example, if it is 10 meters from the battery to the load, the cable should be sized to allow no more than 2 x 10 x .030 = 0.6 volt drop.*

Interblock cables can be provided on request, in order to help select cable sizes for inter-tier and load connections, the following table should be consulted :

CABLE PROPERTIES AT 20ºC

U.S. CABLE SIZE	*AREA mm²*	*MAX. AMPS 30mv DROP/M*
8 AWG	8.4	15
6	13.3	23
4	21.2	37
2	33.6	59
1	42.4	74
0	53.5	93
00	67.4	117
000	85.0	148
0000	107.2	187
250 MCM	126.7	221
350 MCM	177.4	309
400 MCM	202.4	353

Use 1.74 amps/mm² for other cable sizes.

5.5.2 *Terminal Preparation*

Gently clean the contact surface of the terminals with a brass bristle brush or a Scotch Brite pad. Immediately after this cleaning, apply a thin layer of No-Ox-Id "A" or NCP-2 antioxidant grease to the contact areas. A petroleum jelly such as "Vaseline" may also be used.

5.5.3 *Connector Installation*

Install any cables (positive of one battery to negative of the next) and the hardware. Hand tighten only at this time to allow room for positioning of the blocks. Once all cables are in place, all connections should be torqued to the values below :

6 & 12V Monobloc *6 N-m*

Do not over-torque.
CAUTION: Use extreme care not to short the battery connections. Wing 6/12 Volt Monobloc batteries are capable of very high short circuit currents containing a very high energy level.

Install the inter-tier cabling at this time, following the same general instructions as for installing the inter-block connections. Attach the inter-tier cabling to the wall or the rack so that the weight of the cable is not on the battery terminal. If using a stiff cable, pre-bend the cable so no 'spring' force is placed on the battery terminals. Failure to support the cable weight could result in a premature battery failure and loss of battery integrity.

5.5.4 Voltage Checks

Visually check that all connections are properly made (positive to negative) and are tight. Measure the total string voltage.

CAUTION: High voltage present.

The total string voltage should be approximately 6.4 or 12.80 for 6/12 Volt monoblock batteries, multiplied by the number of blocks in the string. If the measured string voltage is not close to the calculated value, recheck the battery connections to ensure proper polarity sequence and measure the individual block voltages. Calculate the average Monobloc voltage and use this value to refigure the string voltage. If the recalculated and measured string voltages do not match reasonably well, contact Wetac for further instructions.

5.5.5 Battery to Charger Connection

Ensure that the charger is disconnected from the power line. If a battery disconnect is installed, open it. The positive terminal of the battery bank should be connected to the positive terminal of the charger and the negative terminal of the battery bank should be connected to the negative terminal of the charger.

5.5.6 Paralleling of Batteries

When greater battery capacity is desired than what is available from a single cell or string, paralleling of batteries becomes necessary.

Batteries must be properly paralleled in order to get the best system performance and longest battery life. The battery strings must be treated as equally as possible. This means equal length cabling to a common collection point for the load cables, uniform temperature between the strings and equal strings of batteries. Do not parallel flooded batteries with valve-regulated batteries as the charge voltages differ between the types of batteries.

To check the proper paralleling of the strings, connect the strings in the final form and place a load on the battery. Measure the load cable voltage drops. The voltage drops should match within 10%.

SECTION 6 - OPERATION

6.1 Initial Charge

Wing recommends that 6/12 Volt batteries be given an initial charge / equalization charge at the time of installation in order to ensure that the batteries are fully charged and the Monobloc voltages are uniform. If an initial charge is not given at the time of installation then monoblock float voltages may take some months to become uniform.

The initial or equalize charge voltage for the **Wing 6/12 Volt** Monobloc batteries is 2.40 – 2.45 volts per cell at 25ºC. Calculate the initial charge voltage for your installation based on either the number of cells in the string or the number of blocks in the string. Turn on the charger and raise the charger output voltage (using the equalization control) to the calculated value. Leave the string charging at this level for 24 hours. At the end of this time, reduce the charger output voltage to the float voltage level. See Section 6.2. Just prior to reducing the string voltage to the float voltage, measure the monoblock voltages and charge current if possible.

If the charger output cannot be raised to the calculated initial charge voltage or the load cannot tolerate a charge voltage this high, raise the charger output voltage to the maximum permissible level. Measure the charger output voltage per cell. Use the following as a guideline:

Max. Voltage Obtained (20ºC)	Charge Time (Hrs.) Min./Max.
2.33 - 2.35 VPC	12 / 24
2.31 - 2.33 VPC	36 / 48

At voltages below 2.29 VPC adequate equalization will not be obtained. Contact Wetac for additional details on procedures to equalize a battery under these conditions.

If the ambient temperature is not 20ºC, the initial charge voltage will have to be temperature compensated (TC). T C is the process whereby the charge voltage is changed as the function of the battery temperature. The temperature correction factor (TCF) for **Wing 6/12 Volt** Monobloc batteries is -0.003 volts / cell / ºC from a 20ºC baseline temperature. As the battery temperature rises (falls) above (below) 20ºC, the charge voltage must be reduced (raised) the TCF amount for every degree of change. The formula to calculate the temperature corrected voltage is :

TCV = CV (20ºC) +/- [T-20 ºC] x (-0.003 v/c)

As an example, if the initial charge were going to be performed at 32ºC the temperature corrected, reduced, charge voltage would be :

TCV = 2.35 - (32-20) x (-0.003 v/c) = 2.314 vpc

6.2 Float Voltage

The float voltage is sometimes known as the continuous charge voltage. It is very important that it be calculated and set properly for maximum battery life and performance. The purpose of the float voltage is to provide enough float voltage and current to the battery to compensate for the battery self-discharge and maintain the battery in a fully charged condition of readiness. Failure to properly follow float voltage recommendations can result in loss of warranty and premature battery failure.

6.2.1 Float Voltage Requirement

The recommended float voltage for the **Wing 6/12 Volt** Monobloc batteries is 2.27 – 2.29 volts/cell at 25ºC. +/- 1ºC.

6.2.2 Float Voltage Temperature Compensation

The float voltage temperature compensation factor is: -0.003 volts per cell per ºC from at 20ºC baseline
(the same as the equalization TCF).
For other temperatures use the following table.

Temperature (ºC)		Float Charge V/C
10		2.315
15		2.300
20	Baseline	2.285
25		2.270
30		2.255
35		2.240

For temperatures outside of this range see Section 6.1 for the equation used for calculation of the temperature corrected float voltage.

6.3 Maximum Charge Current

The charge current is normally limited by using the recommended float voltage. At higher charge voltages the maximum charge current should be limited to prevent the possibility of charging the batteries at a higher rate than they can efficienlty accept. Greater than recommended maximum charge currents can result in excessive battery heating and gassing and a shortened battery life.
For the maximum charge currents see the data sheets :

6.4 Recharge

Recharge batteries immediately or as soon as possible after a discharge. Do not wait more than 24 hours to initiate the recharge after the batteries have been discharged. Failure to follow this recommendation could result in a permanent loss of capacity due to plate sulphation. The approximate recharge time can be calculated as follows:

$$\frac{\text{AH discharged}}{\text{Available charge current}} \times F = \text{charge time Hr.}$$

where F = 3 if the batteries are charged at the float voltage and F = 2 if an equalization voltage is needed. Do not exceed the maximum charge currents listed in Section 6.3.

6.5 Equalization Charge

*The equalization charge voltage of the **Wing 6/12 Volt** Monobloc battery is 2.35 vpc at 20°C. or 2.33 vpc at 25°C. While equalization is not required by the **Wing 6/12 Volt** Monobloc battery under normal operating conditions, it is possible to operate the battery in such a way that equalization would be needed. These conditions would include:*
Temperature variation in the string greater than 3ºC
Low float voltage
Low operational temperature without temperature compensation
Frequent deep discharges
Rapid recharge required
Long delay in recharging the battery after a discharge
Unevenly paralleled string balance

Equalization should be performed on an 'as needed' basis. The standard equalization would be 24 hours at a constant voltage of 2.35 VPC at 20ºC. or 2.33 VPC at 25ºC. For equalization at voltages and temperatures other than the above, see Section 6.1 for methods to compensate.

Section 7 - STORAGE

*When installed **Wing 6/12 Volt** Monobloc batteries will not be used (floated) for a period of time, the following procedure should be followed:*

1. *Equalize charge the battery (refer to Section 6.5).*
2. *Disconnect the battery from all loads. Do not allow any loads, no matter how small, to remain connected.*
3. *Equalize charge the battery every 6 months when the storage temperature is 20ºC or less. For every 8ºC rise in storage temperature, reduce the storage/equalization interval by half.*
4. *Perform an equalization charge on the battery prior to returning to service. During the storage time, particularly if it is extended, it is recommended to continue to monitor and record battery voltage levels. Measure and record the battery open circuit voltage just before equalization and then record the on-charge voltage and current just prior to completing the charge. Refer to Section 4.0 for more information.*

Section 8.0 - MAINTENANCE AND RECORD KEEPING

Maintenance and record keeping is critical to battery life and warranty continuance. Proper maintenance will ensure that the batteries are being correctly used and will be available when needed. Proper record keeping will ensure that, if there is a problem with a battery, the customer can demonstrate the batteries were correctly used and so maintain the warranty.

8.1 General Maintenance

*General maintenance of the battery means keeping the battery and surrounding area clean and dry. Since **Wing 6/12 Volt** Monobloc batteries are of low maintenance design, there is no addition of water or specific gravity checks needed for the life of the battery. The only required maintenance action is an annual re torque of the battery connections; see Table 1 in Section 5.5.1 for re torque values. Review Section 2.4 on Electrical Shock before performing this action.*

CAUTION: Use only insulated tools.
Do not use any solvents or strong cleaners on or around the batteries. A dry brush may be used to remove any dust accumulations. If required, a solution of 1 kg of baking soda in 4 liters of water may be used as a multipurpose cleaner if more stubborn stains or dirt accumulations are present. Follow the rack or cabinet manufacturer's instructions for maintenance if required.

8.2 General Records

8.2.1 Installation Records
When the battery is first received, record:

- *Date of receipt,*
- *Condition of the battery blocs,*
- *Open circuit voltage of each monoblock,*
- *Date of installation*
- *Original P.O. number*
- *Installer (s)*
- *Equalization time and voltage*
- *Any unusual storage conditions.*
- *Individual block float voltages,*
- *Ambient temperature,*
- *Float current,*
- *Battery temperature,*
- *String float voltage.*

8.2.2 Maintenance Records

Twice per year, record the following :

- *Block float voltages*
- *String voltage*
- *Float current*
- *Ambient temperature*
- *Battery temperature*
- *Battery conditions*
- *Any unusual charges or discharges - last 6 months.*

Keep the above records in a safe place for review by maintenance personnel. Remember, these records are mandatory for any warranty claim on the battery.

SECTION 9 - CAPACITY TESTING

9.1 General

Discharge testing of the battery is performed to determine the battery capacity. There are two reasons for performing this test:

(1) A ratings test discharge - the intention here is to determine the percent of battery capacity as compared to the rated capacity. This is typically an 8 hour discharge test.

(2) A service test discharge - this test is to determine the battery standby time under the actual load conditions of intended battery usage.

The ratings test discharge is usually performed using a suitably designed and sized load bank to provide a constant DC current load to the battery. The test is performed for the specified period of time to an end-point voltage per cell (usually 1.75 - 1.85 VPC) with the ampere hour capacity of the battery calculated by multiplying the load current by the number of hours of run time. The actual AH capacity can be compared to the rated AH capacity to determine percentage capacity. This type of test is usually used as an acceptance test of the battery.

The service test is usually performed by placing the actual load on the battery and determining the actual time the battery will support the load. This test is done, in the case of a UPS, by switching into a test mode where the battery becomes the primary source and the normal AC line becomes the back-up. If the load is not critical, the AC input can simply be shut off to simulate a loss of power event and total system operation can be verified as well. A load bank can be used if the normal battery load is well defined.

9.2 Test Procedure

The battery test procedure for either test is :

(1) Ensure the battery is fully charged before capacity testing and that all connections are clean and tight. If the battery has not been on float for at least one week, perform an equalization charge, return the battery to float charge and allow at least 1 hour to stabilize.

(2) Prepare the load bank or test load system. Ensure all temporary cable connections are secure and connected to the proper polarity, and have sufficient current carrying capacity.

(3) Determine the battery temperature by measuring and recording the temperature of every 6 blocs. Average the readings to determine average battery temperature. Measure the battery temperature in the middle of the side (preferably) or the end wall of the container.

(4) If a ratings test is being performed, the load current or power must be temperature corrected if the battery temperature is significantly different from 20ºC. The formula for calculating corrected load is :

Temperature corrected load = load at 20ºC x CF, where CF is the capacity Correction Factor for temperature.

The following table should be used :

Test Temperature (ºC)	*Capacity Correction Factor (CF)*
0	*0.84*
5	*0.89*
10	*0.94*
15	*0.97*
20	*1.00*
25	*1.02*
30	*1.04*
35	*1.05*

If the service test is being performed, no temperature correction is necessary.

(5) Just prior to starting the discharge test, measure and record the individual block voltages, the string voltage and float current (if available).

(6) Remove or disconnect the charger from the battery string.

(7) Connect the load to the battery and start a timer. Monitor the string voltage and record the lowest voltage reached and the time reached (this is called the coup de fouet and is indicative of a fully charged battery).

(8) Record the load current, string and individual cell voltages on a regular basis. A minimum of three sets of readings should be taken. The time interval between sets of readings will vary based on the expected test time. For example, take readings every hour for the first 4 hours of an 8 hour rating test. For the following 3 hours take readings every ½ hour. For the last hour, take readings every 15 minutes. For a 15 minute UPS discharge, readings every 1 to 3 minutes would be desirable.

(9) Continue the discharge until the string voltage drops below the end-point voltage per monobloc times the number of blocks in the string. For example:

1.75 VPC x 6 x 4 blocks = 42.0 Volts

is the stop discharge voltage.

(10) Stop the timer and remove the load from the battery.

(11) Recharge the battery using the existing charger or an external charger. An equalize voltage may be used to reduce charge time.

(12) Record the discharge time and calculate % capacity if a ratings test was performed.

(13) Keep a copy of all the test data with the battery records.

9.3 Discharge Test Notes:

*(1) **Wing 6/12 Volt** batteries are shipped at 95% capacity*

(2) String voltage should be measured at the battery terminals, not at the load connections.

(3) Accurate meters are essential for correct test results. Ensure that all meters, shunts, etc., are properly calibrated before use.

(4) If a long duration test is being performed, the terminal-to-terminal voltage drop across the intercell connections should be measured and recorded. This will serve as a reference for any needed terminal maintenance work and will assist in verifying the battery integrity.

(5) A float voltage check after the test and recharge is recommended.

BATTERY NOTES