HydroLynx Systems, Inc.

Model 5031-XX
Gel Cell Battery

Instruction Manual

Document No: A102851
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Receiving and Unpacking

Carefully unpack all components and compare to the packing list. Notify HydroLynx Systems immediately concerning any discrepancy. Inspect equipment to detect any damage that may have occurred during shipment. In the event of damage, any claim for loss must be filed immediately with the carrier by the consignee. If the equipment was shipped via Parcel Post or UPS, contact HydroLynx Systems for instructions.

Returns

If equipment is to be returned to the factory for any reason, call HydroLynx 8:00 a.m. and 4:00 p.m. Pacific Time to request a Return Authorization Number (RA#). Include with the returned equipment a description of the problem and the name, address, and daytime phone number of the sender. Carefully pack the equipment to prevent damage during the return shipment. Call HydroLynx for packing instructions in the case of delicate or sensitive items. If packing facilities are not available, take the equipment to the nearest Post Office, UPS, or other freight service and obtain assistance with packaging. Please write the RA# on the outside of the box.

Warranty

HydroLynx Systems warrants that its products are free from defects in material and workmanship under normal use and service for a period of one year from the date of shipment from the factory. HydroLynx Systems' obligations under this warranty are limited to, at HydroLynx's option: (i) replacing; or (ii) repairing; any product determined to be defective. In no case shall HydroLynx Systems' liability exceed product's original purchase price. This warranty does not apply to any equipment that has been repaired or altered, except by HydroLynx Systems, or that has been subjected to misuse, negligence, or accident. It is expressly agreed that this warranty will be in lieu of all warranties of fitness and in lieu of the warranty of merchantability.

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1.0 INTRODUCTION

1.1 General Description

The Model 5031-XX Gel Cell Battery is a sealed lead-acid type battery which allows safe operation in any position. The selection of battery capacity (C) is based on the operational requirements of the equipment. The standard HydroLynx batteries' specifications are given here; however, batteries with up to 100 Ampere Hour (AH) can be supplied for non-standard power requirement.

1.2 Specifications

Model 5031	**-7Y**	**-12Y**	**-12**	**-18**
Capacity (AH)	7	12	12	17.5
Length (inches)	6.0	6.0	8.4	7.1
Width (inches)	2.5	3.8	2.8	3.0
Height (inches)	4.0	4.0	5.5	6.6
Weight (pounds)	6.0	10.0	11.0	13.0
Voltage	12 Vdc			
Operating temperature	-76 to +140 degrees F			
Charging cycles	500			
Average life	5 years			

2.0 INSTALLATION

Warning: Battery polarity must be observed when battery is connected; reverse polarity **WILL** cause equipment damage and may cause personal injury.

2.1 5031-12 Battery Bracket

For many years the Standard ALERT battery was the 5031-12. This battery's terminals are offset from the longitudinal center line. To offer protection against reverse polarity a battery bracket was designed which allows access to the terminals when the bracket is placed on the battery in only one direction. The power harness wires are attached to the bracket so that the correct polarity is observed when the terminals are accessible.

2.2 Battery Harness Connector

There is no longer a Standard ALERT battery. This fact eliminates the battery bracket and the reverse polarity protection it offered. A polarized connector has been added to the HydroLynx equipment power harness to provide reverse polarity protection (refer to drawing AC108055). An adapter harness can be installed on older equipment when changing to a new battery style (refer to drawings # AC108054 & AC108063).

It is intended that each battery be equipped with it's own harness; to replaced a battery: disconnect the polarized connector, remove the battery and harness, connect the replacement battery's harness to the polarized connector and return equipment to service.

3.0 THEORY OF OPERATION

3.1 Electrochemical Reaction

A lead-acid battery produces electrical energy from an electrochemical reaction. This is a reversible reaction which allows the battery to discharge/charge repeatedly. The chemical formula for the lead-acid cell is:

$$Pb + PbO_2 + 2H_2SO_4 \leftrightarrow 2PbSO_4 + 2H_2O$$

On discharge the lead (Pb), negative plate, and the lead dioxide (PbO_2), positive plate, react with sulfuric acid (H_2SO_4) to form lead sulfate ($PbSO_4$), water (H_2O) and energy. During the charge cycle of the reaction an external electrical source converts the lead sulfate and water into lead, lead dioxide and sulfuric acid.

3.2 Capacity (C)

Capacity (C) is described as the total amount of electrical energy available from a fully charged battery and is express in ampere-hours (AH): the product of the discharge current and the total discharge time. The rated capacity of a battery is based on its performance over a 20 hour constant current discharge (0.05C), to a cutoff voltage of 10.5 Vdc.

3.2.1 Open Circuit Voltage vs. Capacity

The open circuit voltage varies in an approximately linear response to the remaining capacity of the battery. The open circuit voltage is given as 12.9 Vdc when fully charge and 11.64 Vdc when completely discharged. However, for estimation purposes we assume 13.0 Vdc as charged and 12.0 Vdc as discharged; therefore, a battery's open circuit voltage measured at 12.5 Vdc would indicate a capacity of 50% (0.5 C).

3.2.2 Temperature vs. Capacity

The ambient temperature affects the actual capacity. The rated capacity is 100% at 68°F and decreases to about 80% at 32°F. The capacity increases slightly as the temperature increases above 68°F but the useful service life decreases; it is estimated that battery life is halved for each 20°F increase above 68°F.

3.2.3 Rate of Discharge vs. Capacity

The discharge rate also affects the battery's rated capacity. The higher the discharge rate the lower the capacity. This must be taken into account during discharge tests (refer to Battery Performance Curve).

3.3 Battery Use

The original ALERT concept of a remote site operated on battery power only is an example of Cyclic Use. Battery capacity dictates the length between maintenance trips. More often now ALERT users are adding solar panels to their remote sites, which is an example of Standby Use and battery replacement becomes an option rather than a requirement.

3.3.1 Cyclic Use

The number of charge/discharge cycles depends on the capacity taken from the battery, operating temperature and the charging method. The average of 500 charge/discharge cycles is much larger than an ALERT battery will experience so this is not a limiting factor on battery service life.

3.3.2 Standby Use

For standby use, the service life depends on the frequency and depth of discharge, the charge voltage and the ambient temperature. The average life expectancy is five years before the capacity drops to 60% of its original rating.

3.3.3 Shelf Life - Self Discharge

The rate of self discharge varies with the ambient temperature; at 68°F the rate is about 3% a month. At low temperatures it is nearly negligible while at 100°F it increases to 20% a month.

3.4 Charging

To charge a battery a DC voltage higher than then the fully charged open circuit voltage of 12.9 Vdc is applied to the battery. The battery may be charge using any of the conventional charging techniques; however, for maximum service life and capacity a constant voltage-current limited charge is recommended.

3.4.1 Constant Voltage Charging

During constant voltage charging the battery's current acceptance decreases as voltage and charge increase. The battery is fully charge once the current stabilizes at a low level for a few hours.

3.4.2 Two Step Constant Voltage Charging

This method uses two constant voltage levels. In the initial charge phase the high voltage level is used. When charging is nearly complete and the battery voltage has risen to a specified value the charger switches to the lower voltage level. This method allows rapid charging in cycle or float service without overcharging.

4.0 TESTING AND MAINTENANCE

Caution: Under NO condition should a Model 5031 Battery be deep discharged, i.e. discharged below 10 volts.

4.1 Testing

Field testing the battery becomes a necessity when, due to the use of solar panels, battery replacement is not a regular maintenance item. The Charge/Discharge/Charge Test determines the capacity of a battery. The self discharge test checks the batteries ability to hold a charge over time.

4.1.1 Field Testing

- Remove solar panel from Data Transmitter
- Read w/o load Battery Voltage
- Initiate transmission (load)
- Read minimum voltage - w/ load Battery Voltage
- Subtract w/ load from w/o load Battery Voltages.
- Limit: $\leq$0.5 Vdc
- Note: This is a typical value based on the typical radio current draw, higher current load will increase this value.

4.1.2 Charge/Discharge/Charge Test

- Fully charge battery
- Discharge at a known current
- Record time to discharge battery to 10.5 Vdc
- C = known current x time to discharge (AH)
- Limit: compare to rated battery capacity
- Record Results on battery (refer to drawing A100911)

The Model 5032 Battery Discharger measures the discharge time and disconnects the battery when the discharge voltage is reached (refer to the 5032 manual for procedure).

4.1.3 Self Discharge Test

- When a battery is placed into storage record the open circuit voltage and the date on the battery label. (refer to drawing #A100911);
- When returning the battery to service measure the open circuit voltage and estimate the capacity (refer to section 3.2.1).
- Limit: Compare the amount of self discharge to the expected amount of 3% per month
- Note: charge the battery before returning it to service.

4.2 Maintenance

Sealed batteries are some times referred to as maintenance-free; this refers to the fact that there is no need to add electrolyte to the battery. Besides proper charging and storage of the batteries maintenance includes visual checks and proper disposal of the batteries.

4.2.1 Charging

Batteries are fully charged before leaving the factory, but full capacity is only realized after the battery has been cycled a few times or been on float charge for some time. HydroLynx Model 5030 Charger and Model 5033-XX Solar Panel regulators employ the Two Step Constant Voltage method for charging (refer to section 3.4.2).

4.2.2 Storage

To obtain maximum battery life and performance batteries should be:
- recharged as soon as possible after use and not stored in a discharged state
- stored at 68°F or lower
- recharged annually when not in use.

4.2.3 Visual Battery Check

Warning: Contact with sulfuric acid can cause personal injury. Wash skin and/or cloths with liberal amounts of water.

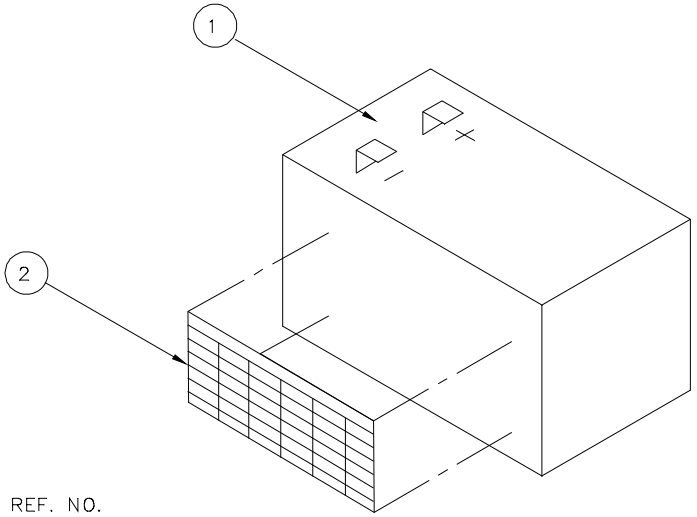
- Check for signs of fluid leakage, discontinue use and dispose battery at any sign of fluid leakage. The battery has a double seal, the battery may still be used if the outer case cracks but the battery does not leak fluid and passes tests.
- Check battery terminals for corrosion; clean terminals and connector.
- Check battery terminal connections to be sure they fit snugly. If they become lose, use needle-nose pliers to tighten; start at the back of the connector and squeeze gently to tighten each flange.

4.2.4 Disposal of Failed Batteries

It is unlawful to dispose of batteries except through a recycling center.

5.0 DRAWINGS

AC108057 Assembly - Battery with Maintenance Label
AC108054 Assembly - Harness Extension; Upgrade
AC108063 Install - Harness; Upgrade
AC100899 Battery Performance Curve - Voltage vs Time
A100911 Battery Maintenance Labels



NOTES:

1. (2) → NUMBER IN BUBBLE IS 5031-12 BM REF. NO.
2. TOP BM REF. NO. IS 1.1.4.0.

ECN#	DESCRIPTION	DATE

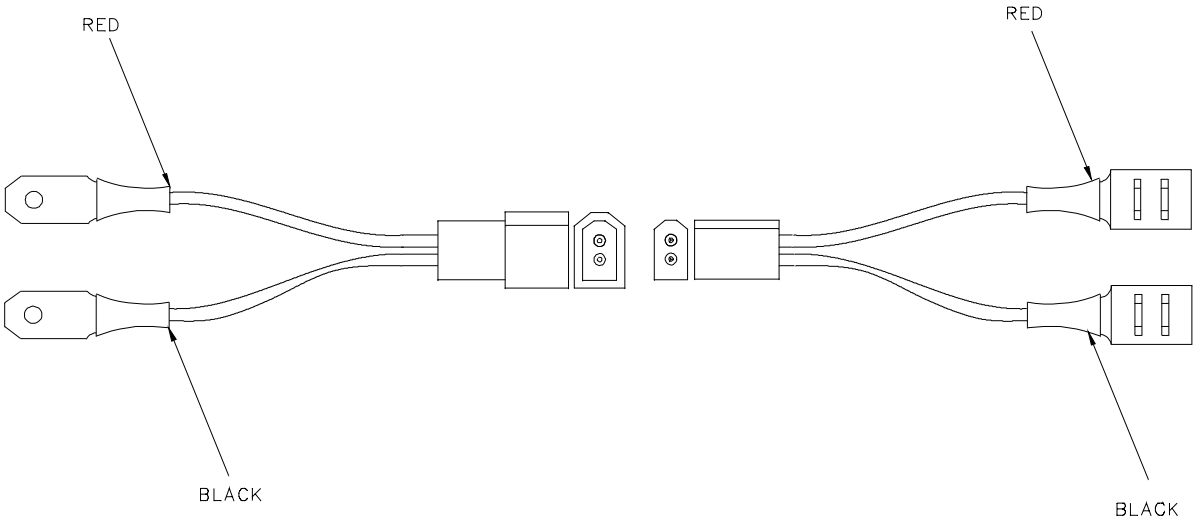
MODEL USAGE

HydroLynx

MODEL NO.	5031-12
TITLE	BATTERY WITH MAINTENANCE LABEL
DRAWN BY: O. SCIORELLI — DATE: 01/21/00	DWG TYPE: ASSEMBLY
CHECKED BY — DATE	SIZE: A — DWG NO.: AC108057 — REV

NOTES:

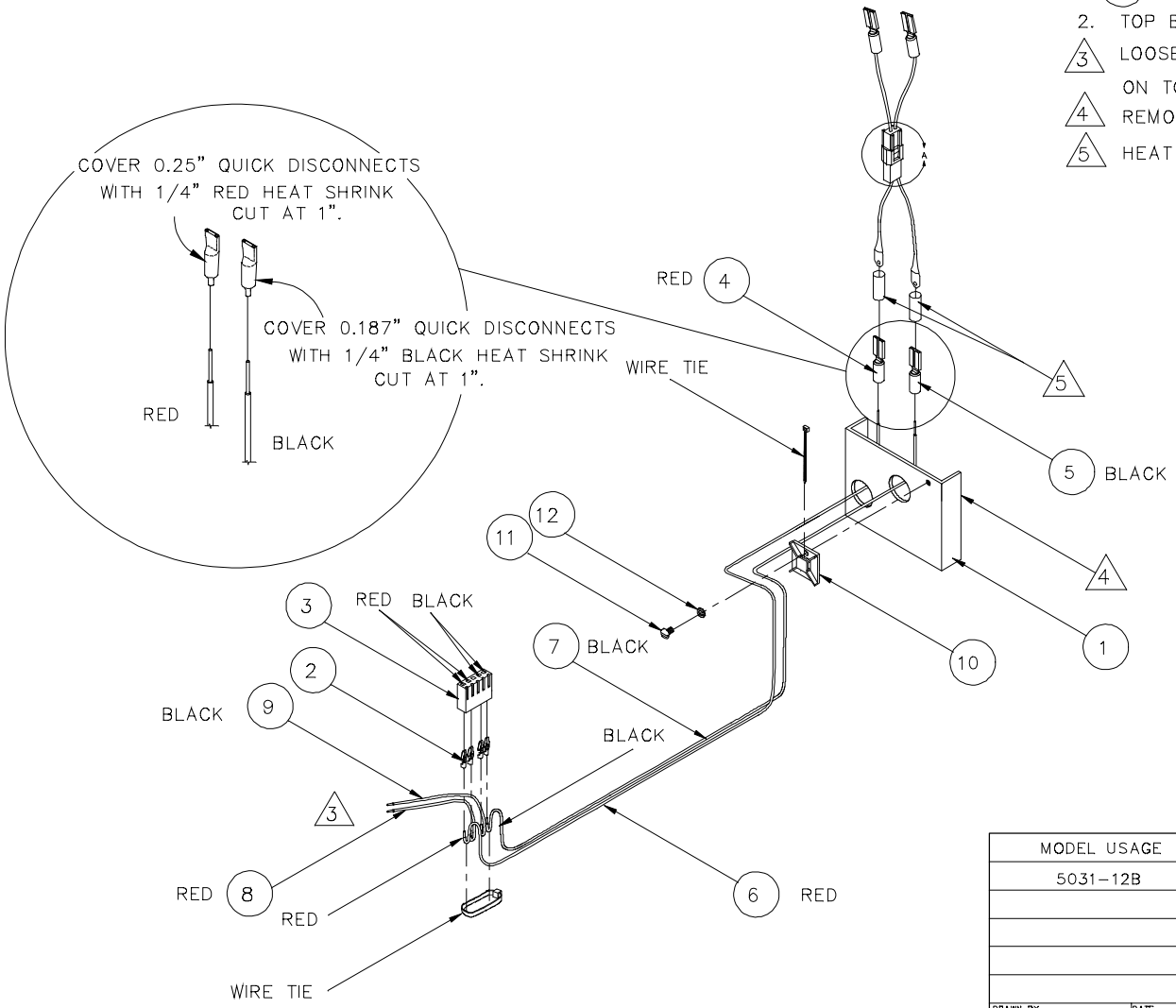
1. 18 AWG HOOKUP AT 6" RED AND BLACK.

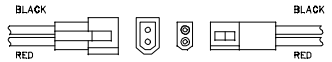


MODEL USAGE		HydroLynx	
		MODEL NO.	5096WH
		TITLE	HARNESS, EXTENSION FOR 5031-12B
DRAWN BY: O. SCIORELLI	DATE: 01/25/00	DWG TYPE	ASSEMBLY
CHECKED BY	DATE	SIZE: A / DWG NO.: AC108054	REV

NOTES:

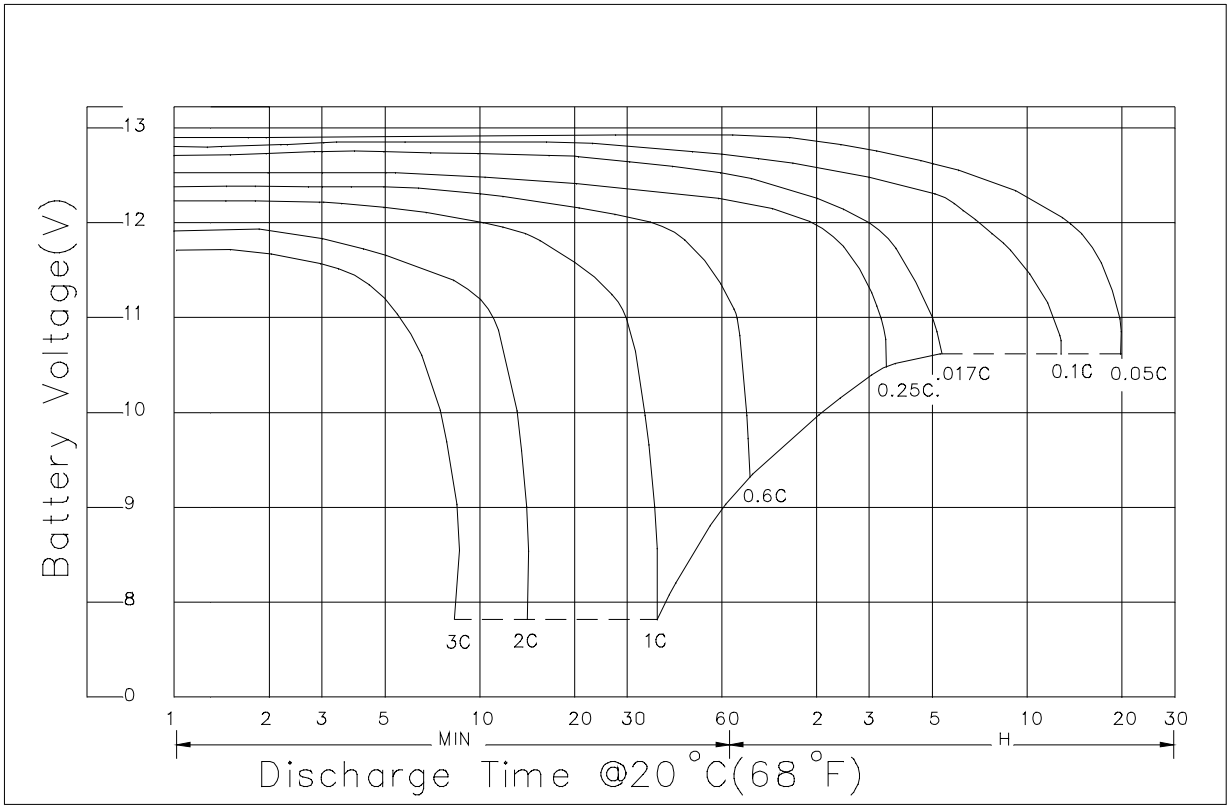
1. (6) NUMBER IN BUBBLE IS BOM REF. NO.
2. TOP BOM REF. NO. IS X.1.2.3.
3. LOOSE WIRE ENDS CONNECT TO POWER CONNECTOR ON TOP PLATE.
4. REMOVE BAT. BRACKET ADD AC108054 EXTENSION.
5. HEAT SHRINK AFTER CONNECTION.





DETAIL A

MODEL USAGE		HydroLynx	
5031-12B			
		MODEL NO.	5096 WH
		TITLE	HARNESS, BATTERY UPGRADE
			5031-12B
DRAWN BY: O. SCIORELLI	DATE: 01/25/00	DWG TYPE	INSTALL
CHECKED BY	DATE	SIZE: B	DWG NO.: AC108063 REV



MODEL USAGE		HydroLynx		
		MODEL NO. 5032		
		TITLE BATTERY DISCHARGER VOLTAGE VS. TIME		
DRAWN BY V.BOJKO	DATE 013001	DWG TYPE CURVE		
CHECKED BY	DATE	SIZE A	DWG NO. AC100899	REV

HydroLynx Battery Maintenance **A100911**

Charge	Discharge	Charge	Date	Shelf	Date
Vdc	Min	Vdc		Vdc	
Vdc	Min	Vdc		Vdc	
Vdc	Min	Vdc		Vdc	
Vdc	Min	Vdc		Vdc	
Vdc	Min	Vdc		Vdc	
Vdc	Min	Vdc		Vdc	

HydroLynx Battery Maintenance **A100911**

Charge	Discharge	Charge	Date	Shelf	Date
Vdc	Min	Vdc		Vdc	
Vdc	Min	Vdc		Vdc	
Vdc	Min	Vdc		Vdc	
Vdc	Min	Vdc		Vdc	
Vdc	Min	Vdc		Vdc	
Vdc	Min	Vdc		Vdc	

HydroLynx Battery Maintenance **A100911**

Charge	Discharge	Charge	Date	Shelf	Date
Vdc	Min	Vdc		Vdc	
Vdc	Min	Vdc		Vdc	
Vdc	Min	Vdc		Vdc	
Vdc	Min	Vdc		Vdc	
Vdc	Min	Vdc		Vdc	
Vdc	Min	Vdc		Vdc	

HydroLynx Battery Maintenance **A100911**

Charge	Discharge	Charge	Date	Shelf	Date
Vdc	Min	Vdc		Vdc	
Vdc	Min	Vdc		Vdc	
Vdc	Min	Vdc		Vdc	
Vdc	Min	Vdc		Vdc	
Vdc	Min	Vdc		Vdc	
Vdc	Min	Vdc		Vdc	

HydroLynx Battery Maintenance **A100911**

Charge	Discharge	Charge	Date	Shelf	Date
Vdc	Min	Vdc		Vdc	
Vdc	Min	Vdc		Vdc	
Vdc	Min	Vdc		Vdc	
Vdc	Min	Vdc		Vdc	
Vdc	Min	Vdc		Vdc	
Vdc	Min	Vdc		Vdc	

HydroLynx Battery Maintenance **A100911**

Charge	Discharge	Charge	Date	Shelf	Date
Vdc	Min	Vdc		Vdc	
Vdc	Min	Vdc		Vdc	
Vdc	Min	Vdc		Vdc	
Vdc	Min	Vdc		Vdc	
Vdc	Min	Vdc		Vdc	
Vdc	Min	Vdc		Vdc	