an EnerSys company

AlphaCell™ 210HP User Guide

Effective: December 2019

Safety Information

Alpha considers customer safety and satisfaction its most important priority. To reduce the risk of injury or death and to ensure continual safe operation of this product, certain information is presented differently in this manual. Alpha tries to adhere to ANSI Z535 and encourages special attention and care to information presented in each notification.

Each section in this manual contains important safety information that must be followed during the installation and maintenance of the equipment and batteries. Read all of the instructions before installing or operating the equipment and save this manual for future reference.

WARNING! GENERAL HAZARD

GENERAL HAZARD WARNING provides safety information to PREVENT INJURY OR DEATH to the technician or user.

WARNING! ELECTRICAL HAZARD

ELECTRICAL HAZARD WARNING provides electrical safety information to PREVENT INJURY OR DEATH to the technician or user.

WARNING! FUMES HAZARD

FUMES HAZARD WARNING provides fumes safety information to PREVENT INJURY OR DEATH to the technician or user.

WARNING! FIRE HAZARD

FIRE HAZARD WARNING provides flammability safety information to PREVENT INJURY OR DEATH to the technician or user.

There may be multiple warnings associated with the call out. Example:

WARNING! ELECTRICAL & FIRE HAZARD

This WARNING provides safety information for both Electrical AND Fire Hazards

CAUTION!

CAUTION provides safety information intended to PREVENT DAMAGE to material or equipment.

***NOTICE**:*

NOTICE provides additional information to help complete a specific task or procedure.

ATTENTION:

ATTENTION provides specific regulatory/code requirements that may affect the placement of equipment and /or installation procedures.

AlphaCell™ 210HP Battery User Guide

Storage, Maintenance and Deployment

746-681-B13-001, Rev. A

Effective Date: December 2019

Disclaimer

Images contained in this manual are for illustrative purposes only. These images may not match the current installation.

Operator is cautioned to review the drawings and illustrations contained in this manual before proceeding. If there are questions regarding the safe operation of this powering system, please contact Alpha Technologies or the nearest Alpha representative.

Alpha shall not be held liable for any damage or injury involving its enclosures, power supplies, generators, batteries or other hardware if used or operated in any manner or subject to any condition not consistent with its intended purpose or is installed or operated in an unapproved manner or improperly maintained.

Contact Information

Sales information and customer service in USA (7AM to 5PM, Pacific Time):	1 800 322 5742
Complete technical support in USA (7AM to 5PM, Pacific Time or 24/7 emergency support):	1 800 863 3364
Sales information and technical support in Canada:	1 888 462 7487
Website:	www.alpha.com

Table of Contents

Figures

Tables

AlphaCell 210HP Battery Safety Notes

Review the drawings and illustrations contained in this manual before proceeding. If there are any questions regarding the safe installation or operation of the system, contact Alpha Technologies Services, Inc. or the nearest Alpha representative. Save this document for future reference.

To reduce the risk of injury or death, and to ensure the continued safe operation of this product, the cautionary symbols have been placed throughout this manual. Where these symbols appear, use extra care and attention.

Failure to follow these instructions could result in burns, severe shock or possible electrocution. Use extreme caution at all times to prevent accidents.

WARNING! PERSONAL INJURY HAZARD

Some batteries can weigh in excess of 100 lb (45 kg). Use safe lifting techniques when lifting this equipment as prescribed by the Occupational Safety and Health Association (OSHA) or other local codes. Lifting machinery may be recommended as necessary.

Wear appropriate protective equipment when working with batteries, including eye or face protection, acid-resistant gloves, an apron, and other items.

Wash hands after any contact with the lead terminals or battery electrolyte.

WARNING! EXPLOSION, ELECTRICAL, OR FIRE HAZARD

Ensure clearance requirements are strictly enforced around the batteries.

Ensure the area around the batteries is well ventilated and clear of debris.

Never smoke, or allow a spark or flame near, the batteries.

Always use insulated tools. Avoid dropping tools onto batteries or other electrical parts.

Keep plenty of fresh water and soap nearby in case battery acid contacts skin, clothing, or eyes.

Wear complete eye and clothing protection when working with batteries. Avoid touching bare skin or eyes while working near batteries.

If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters the eye, immediately flood it with running cold water for at least 20 minutes and get medical attention as soon as possible.

Never charge a frozen battery.

Insulate batteries as appropriate against freezing temperatures. A discharged battery will freeze more easily than a charged one.

If a battery must be removed, always remove the grounded terminal from the battery first. Make sure all devices are de-energized or disconnected to avoid causing a spark.

Do not perform any servicing other than that specified in the installation instructions unless qualified to do so and have been instructed to do so by Alpha Technical Support personnel.

ADDITIONAL RESOURCES

These references may be used when installing this equipment. Depending on the nature of the installation, it may be highly recommended to consult these resources.

Institute of Electrical and Electronics Engineers (IEEE) guidelines: IEEE 450, IEEE 484, IEEE 1184, IEEE 1187, IEEE 1188, IEEE 1189, IEEE 1491, IEEE 1578, IEEE 1635, and IEEE 1657 (various guidelines for design, installation, maintenance, monitoring, and safety of battery systems)

Battery Maintenance Guidelines

For optimal performance, inspect batteries every 6 months for:

Signs of battery cracking, leaking or swelling. The battery should be replaced immediately by authorized personnel using a battery of the identical type and rating **(match voltages and date codes as specified in this document).**

Signs of battery cable damage. Battery cable should be replaced immediately by authorized personnel using replacement parts specified by vendor.

Loose battery connection hardware. Refer to documentation for the correct torque and connection hardware for the application.

NOTICE:

The Battery terminal hardware supplied with the AlphaCell 210HP battery is M6 and should be torqued according to the manufacturer's specifications.

- Do not attempt to remove the vents (valves) from the AlphaCell 210HP battery or add water. This is a safety hazard and voids the warranty.
- Apply corrosion-inhibiting grease on all exposed connections.
- When necessary, clean up any spilled electrolyte in accordance with all federal, state, and local regulations or codes.
- Follow approved storage instructions.
- Always replace batteries with those of an identical type and rating. Never install untested batteries.

All battery compartments must have adequate ventilation to prevent an accumulation of potentially dangerous gas. Never place batteries in a sealed enclosure. Extreme caution should be used when maintaining and collecting data on the battery system.

Recycling and Disposal Instructions

- Spent or damaged batteries are considered environmentally unsafe as they contain lead and dilute sulfuric acid. They should not be "thrown away" with common refuse.
- Always recycle used batteries in accordance with federal, state, provincial, and local regulations. Alpha Technologies Services, Inc. provides assistance with recycling old or damaged batteries. If you would like to submit a recycling request, visit http://batteryrecycling.alpha.com and fill out the form to get started.

Transportation Information

All AlphaCell 210HP batteries are identified as “Battery, Electric Storage, Wet, Non-spillable” when transported by air, sea or by land transportation. Batteries must be identified as above on the Bill of Lading and properly packaged with their terminals protected from short circuit. NA or UN numbers do not apply. The AlphaCell 210HP battery warning label identifies each battery as NON-SPILLABLE.

AlphaCell 210HP sealed lead-acid batteries are classified as “Non-spillable” for the purpose of transportation by DOT, and IATA/ICAO as result of passing the Vibration and Pressure Differential Test described in DOT [49 CFR 173.159(f)] and IATA/ICAO [Special Provision A67]. AlphaCell 210HP sealed lead-acid batteries can be safely transported on deck, or under deck stored on either a passenger or cargo vessel as result of passing the Vibration and Pressure Differential Tests as described in the IMDG regulations (Special Article 238).

To transport these batteries as “Non-spillable,” the terminals must be protected from short circuit and the battery must be securely packaged to withstand normal shipping conditions. AlphaCell 210HP Batteries packed accordingly are considered unregulated and require no additional special packaging or handling.

For all modes of transportation, each battery and outer package is labeled “NON-SPILLABLE” per 49 CFR 173.159(f). If repackaging batteries or including batteries as a component of another product, the outer packaging must be labeled “NON-SPILLABLE” per 49 CFR 173.159(f).

Important Storage Practices

Storing AlphaCell 210HP Batteries

If the AlphaCell 210HP cannot be installed immediately, it should be stored in a cool, dry location. Avoid placing the battery in areas of high temperature or in direct sunlight. Storing the battery in a high temperature environment increases the rate of self-discharge and reduces the battery's lifespan and capacity.

The AlphaCell 210HP is shipped fully charged and may be stored up to 18 months at 77°F (25°C). A periodic check for Open Circuit Voltages (OCV) is recommended every 6 months. If stored in a warmer environment, voltage checks should be performed more frequently. The batteries must be given a freshening charge once every 18 months or when the OCV drops below 12.6V, whichever occurs first.

At 104°F (40°C), the AlphaCell 210HP battery OCV should be checked once every 2 months. At 86°F (30°C), the maintenance interval and OCV checks can be once every 3 months. At 77°F (25°C) and below, maintenance intervals and OCV checks can be once every 6 months.

FAILURE TO OBSERVE THESE CONDITIONS MAY RESULT IN A REDUCED CAPACITY AND SERVICE LIFE FOR THE BATTERY. FAILURE TO CHARGE AS NOTED VOIDS THE BATTERY WARRANTY.

During storage please note:

- All lead acid batteries experience self-discharge while in open circuit storage. This causes circuit voltage and capacity to decrease. See Section 1.4 for more detail on self-discharge.
- The self-discharge rate is related to ambient temperature. The lower the ambient temperature, the slower the battery will self-discharge.
- It is important to track open circuit voltage which is related to the density of the electrolyte. If the open circuit voltage is lower than 12.0Vdc or the batteries have been stored beyond their limits, the batteries should be charged to avoid damage caused by self-discharge.
- All batteries should be fully charged before storage. Record the storage date and next freshening charge date in a maintenance record and on the battery.
- Upon battery deployment, verify all batteries within each string measure in the range of +/- 0.3Vdc of the string average.

Freshening Charge

The AlphaCell 210HP should be given a freshening charge once every 18 months if left in storage. The battery should charge for 96 hours at 13.62V at 77°F (25°C) or until the charge current does not vary over a three hour period. Alternatively, the freshening charge can be set at 14.4V for 16 to 24 hours or until the charge current doesn't vary over a three hour period.

Electrical Safety

Lethal voltages are present within the power supply and electrical enclosures. Never assume that an electrical connection or conductor is not energized. Check circuits with a volt meter prior to any installation or removal procedure.

- Observe circuit polarities.
- Always work with another technician when working under hazardous conditions.
- Ensure no liquids or wet clothes contact internal components.
- Hazardous, electrically live parts exist inside uninterruptable power supplies (UPS), and are energized from the batteries even when the AC input power is disconnected.
- Use an insulated blanket to cover exposed portions of the battery system when performing extended maintenance that could result in personal or equipment contact with the energized conductors.
- Certain types of rectifier circuits used in charging the battery may not include a line isolating transformer. In these cases, extreme caution should be used when maintaining and collecting data on the battery system.

Chemical Hazards

To avoid injury:

- Servicing and connection of batteries shall be performed by, or under the direct supervision of, personnel knowledgeable of batteries and their required safety precautions.
- Always wear eye protection, rubber gloves, and a protective vest when working near batteries. To avoid battery contact, remove all metallic objects, such as rings or watches.
- Batteries produce explosive gases. Keep all open flames and sparks away from batteries.
- Use tools with insulated handles. Do not rest any tools on top of batteries.
- Batteries contain or emit chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. Battery post terminals and related accessories contain lead and lead compounds. Wash hands after handling (California Proposition 65).
- If any battery emission contacts the skin, wash immediately and thoroughly with water. Follow your company's approved chemical exposure procedures.
- Neutralize any spilled battery emission with the special solution contained in an approved spill kit, or with a solution of 1 pound (454g) sodium bicarbonate in 1 gallon (3.8L) of water. Report a chemical spill using your company's spill reporting structure and seek medical attention if necessary.
- Always replace batteries with those of an identical type and rating ***(match voltages and date codes as specified in this document)***.
- Never install old or untested batteries.
- Prior to handling the batteries, touch a grounded metal object to dissipate any static charge that may have developed on your body.
- Use special caution when connecting or adjusting battery cabling. An improperly connected or unconnected battery cable can make contact with an unintended surface that can result in arcing, fire, or possible explosion.
- A battery showing signs of cracking, leaking, or swelling should be replaced immediately by authorized personnel using a battery of identical type and rating.

Mechanical Safety

- The AlphaCell 210HP battery weighs approximately 132.3 pounds (59.9kg). Exercise care when handling and moving the batteries. Use proper handling equipment and follow safe lifting practices.
- Power supplies can reach extreme temperatures under load. Use caution.
- Use caution around sheet metal components, especially sharp edges.

1.0 Introduction

This manual is intended for use by anyone required to install and operate the AlphaCell 210HP battery. Be sure to review this manual carefully to identify any potential safety risks before proceeding. The owner must be familiar with all the features and functions of the AlphaCell 210HP before proceeding. Failure to install or use this battery as instructed in this manual can result in damage to the battery that may not be covered under the limited warranty.

This guide will address the following topics with regard to the AlphaCell 210HP:

- The storage and maintenance of new battery inventory.
- Deployment into Alpha power systems.
- Proper preventative maintenance practices.
- Replacement and recycling.
- Warehousing, testing, and redeployment of reusable batteries.
- How to keep proper maintenance records for troubleshooting and/or warranty claims.

AlphaCell 210HP Front Terminal Battery

The AlphaCell 210HP is a premium, high performance, float service, Thin Plate Pure Lead (TPPL) battery suitable for broadband inside plant, telecommunications, and high-rate uninterrupted power supply (UPS) applications. Utilizing TPPL technology, this battery yields advantages such as extended float service life and longer shelf life. Further benefits include fast recharge, high-rate UPS operation and demand response with deep discharge capabilities providing optimal back-up runtime for your network power needs.

***NOTICE**:*

Each AlphaCell 210HP is shipped with a jumper cable to be used when connecting multiple batteries.

NOTICE:

For managing your power system and optimizing performance and battery life, Alpha recommends the Alpha Cordex CXC HP System Controller with AlphaCell 210HP batteries. See **Section 7.0 Alpha Cordex CXC HP Controller Settings** for default value settings for 12V, 24V and 48V power systems. Visit www.alpha.com for more detail or to download the Cordex CXC HP System Controller Software Manual *(Alpha p/n 0350058-J0)*.

1.1 Description

The AlphaCell 210HP battery with TPPL technology facilitates a more efficient oxygen recombination cycle. It is comprised of six 2V cells which are internally connected in series to provide 12V power. Batteries can be connected in series to provide higher DC voltage in order to meet the specific needs of your system while still maintaining a nominal capacity rating of 203.8Ah per string.

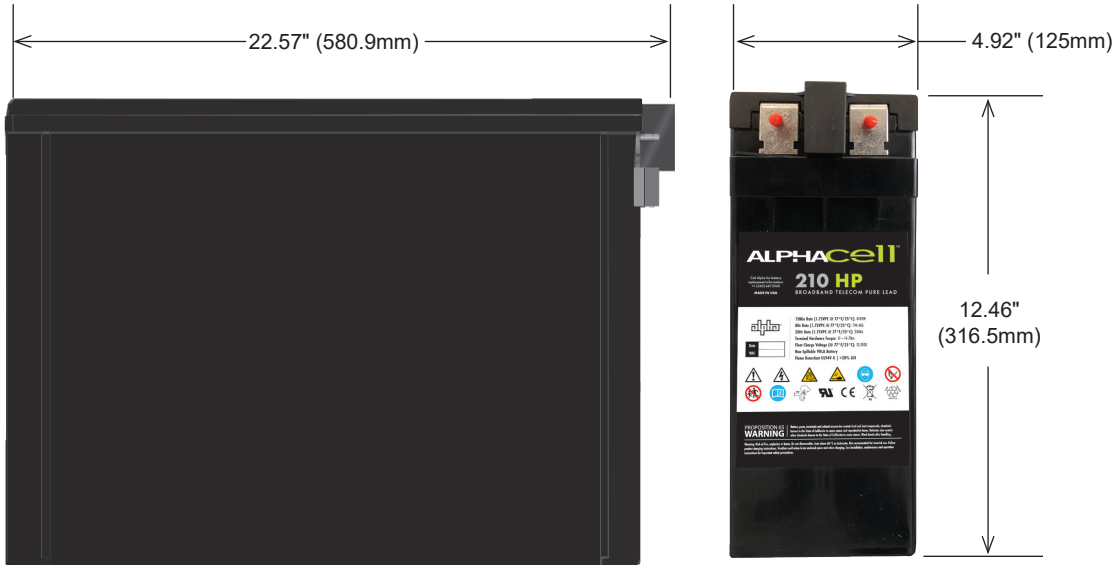

Fig. 1-1, Dimensions, AlphaCell 210HP

1.2 Operating Conditions

AlphaCell 210HP batteries are valve regulated, virtually sealed, and release only trace amounts of gas.

- Acceptable ambient operating temperature: -40°F to 113°F (-40°C to 45°C)
- Ideal ambient operating temperature: 68°F to 77°F (20°C to 25°C)
- Ambient humidity: ≤ 95%

1.3 Capacity

Battery capacity is given in ampere-hours (amp-hours). This is a current draw which is multiplied by the duration of current flow. A draw of X amperes for Y hours equals an accumulation of XY amp-hours.

Because the battery's chemical reaction constantly releases energy, its level of depletion is not always obvious. Smaller loads will deplete the batteries less than larger loads. This effectively means that the battery has more capacity under lighter loads.

For example, if the AlphaCell 210HP is discharged at the 20-hour rate to a voltage of 1.75 Vpc (a load expected to effectively drain 100% of its capacity in 20 hours), it will be measured to have 203.8 amp-hours. However, at the 4-hour rate, a heavier load, only 177 amp-hours will be measured. For discharge rates and amp-hours, see below.

- The higher the discharge rate, the lower the available capacity.
- As batteries age, the available capacity is reduced. This is related to the kinetics of the electrochemical reactions and the resistivity of the electrolyte (see below).

NOTICE:

Although the battery can be operated at temperatures below -4°F (-20°C), the capacity and ability to discharge will be dramatically decreased.

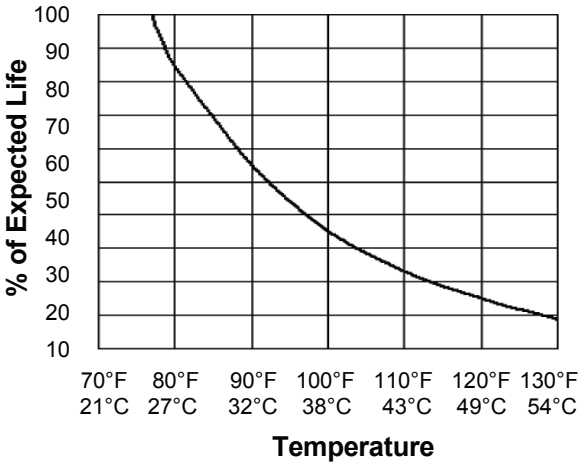

Fig. 1-2, Expected Life vs. Battery Temperature

Ampere Hour Capacity @ 77°F (25°C)															
End Point Volts/Cell	2 min	5 min	10 min	15 min	20 min	30 min	45 min	1 hr	2 hr	3 hr	4 hr	5 hr	8 hr	10 hr	20 hr
1.50V	33.6	62.4	87.9	102.9	113.1	135.0	148.1	156.3	172.3	181.4	185.9	189.1	199.7	202.8	212.5
1.67V	26.3	53.4	79.3	95.1	106.2	127.7	141.9	150.8	168.4	176.2	181.0	184.3	194.6	197.6	208.4
1.75V	21.4	46.0	70.7	86.5	97.7	119.3	134.3	144.0	163.4	172.2	177.4	181.0	191.5	194.4	203.8
1.85V	15.4	35.7	57.9	72.8	83.8	105.0	121.0	131.6	153.7	163.9	170.0	174.0	184.8	187.6	194.8

Table 1-1, AlphaCell 210HP Ampere-Hour Capacity

1.4 Discharge Rates

Self-Discharge

All AlphaCell 210HP batteries will discharge over time once charged, even in storage. Higher storage temperatures increase the rate of self-discharge. At room temperature (77°F or 25°C), the AlphaCell 210HP has a shelf life of 18 months before self-discharging to unacceptable levels. The figure below shows the rate of the AlphaCell 210HP batteries self-discharge at various temperatures.

Fully charged, the natural (“rest”) voltage of all AlphaCell 210HP batteries is approximately 12.8 Vdc. A battery should have a freshening charge if its rest voltage is below 12.0Vdc per battery (2.08Vdc per cell). A battery should not be used if its rest voltage is 12.0Vdc or lower upon delivery. Contact the vendor upon receiving a battery in this state.

No AlphaCell 210HP battery should ever be permitted to self-discharge below 35% state of charge (SoC) or drop to 12.0 Vdc, whichever comes first. Such a condition is highly detrimental and will shorten battery life. (This situation is not the same as discharging to 35% SoC or lower under load.) The battery may be permanently damaged if the Open Circuit Voltage (OCV) is allowed to drop below 11.9Vdc.

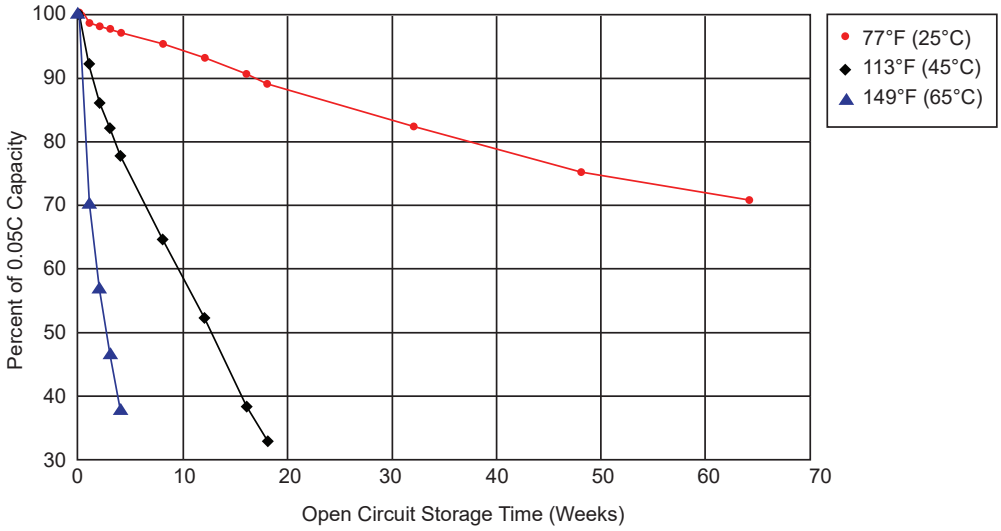

Fig. 1-3, Open Circuit Storage Time vs. Percent of 0.05C Capacity

Constant Current Discharge Rate in Amps @ 77°F (25°C)																
End Point Volts/Cell	2 min	5 min	10 min	15 min	20 min	30 min	45 min	1 hr	2 hr	3 hr	4 hr	5 hr	8 hr	10 hr	20 hr	24 hr
1.50V	1009.4	749.4	527.5	411.5	339.3	270.0	197.5	156.3	86.2	60.5	46.5	37.8	25.0	20.3	10.6	8.9
1.67V	787.6	640.8	475.6	380.4	318.5	255.4	189.1	150.8	84.2	58.7	45.2	36.9	24.3	19.8	10.4	8.8
1.75V	643.1	552.1	424.4	345.8	293.0	238.6	179.1	144.0	81.7	57.4	44.3	36.2	23.9	19.4	10.2	8.6
1.85V	462.1	428.1	347.2	291.2	251.5	210.0	161.3	131.6	76.8	54.6	42.5	34.8	23.1	18.8	9.7	8.2

Constant Power Discharge Rate in Watts @ 77°F (25°C)																
End Point Volts/Cell	2 min	5 min	10 min	15 min	20 min	30 min	45 min	1 hr	2 hr	3 hr	4 hr	5 hr	8 hr	10 hr	20 hr	24 hr
1.50V	9185	7426	5513	4463	3748	3020	2248	1799	1013	718	555	453	300	244	128	108
1.67V	7917	6726	5148	4189	3547	2888	2169	1746	993	699	541	442	293	238	125	105
1.75V	6737	5965	4694	3875	3313	2730	2073	1679	968	685	531	435	289	235	123	104
1.85V	5069	4806	3961	3352	2913	2452	1897	1555	918	656	512	420	280	227	118	99

Table 1-2, AlphaCell 210HP Current and Power Discharge Ratings

2.0 Installation

2.1 System Location

Set Up

AlphaCell 210HP batteries should be installed with a minimum 36” (91.4 cm) clearance in front. This allows access for testing, maintenance, and any other reasons.

If multiple batteries are installed, they should have a minimum of ½” (12.7 mm) clearance on either side. At minimum, each string must be physically inspected every 6 months. Measurement of electrolyte specific gravity, as well as adding water to individual battery cells, is not necessary. All batteries in the string should be numbered to facilitate recording and analysis of data unique to each unit.

Temperature

The optimal temperature range for maximum life and performance of the AlphaCell 210HP batteries is between 68°F (20°C) to 77°F (25°C). These batteries, however, can be used at temperatures from -40°F (-40°C) to 113°F (45°C).

High operating temperatures will shorten a battery’s life. Avoid placing batteries in high temperature areas or in direct sunlight.

Do not allow batteries to freeze as this will damage them and could result in leakage.

Do not expose batteries to temperature variations of more than 5°F (3°C). This can lead to voltage imbalance between multiple batteries (or between multiple battery cells if there is a temperature differential).

Batteries should be stored in a cool, dry location. Place them in service as soon as possible.

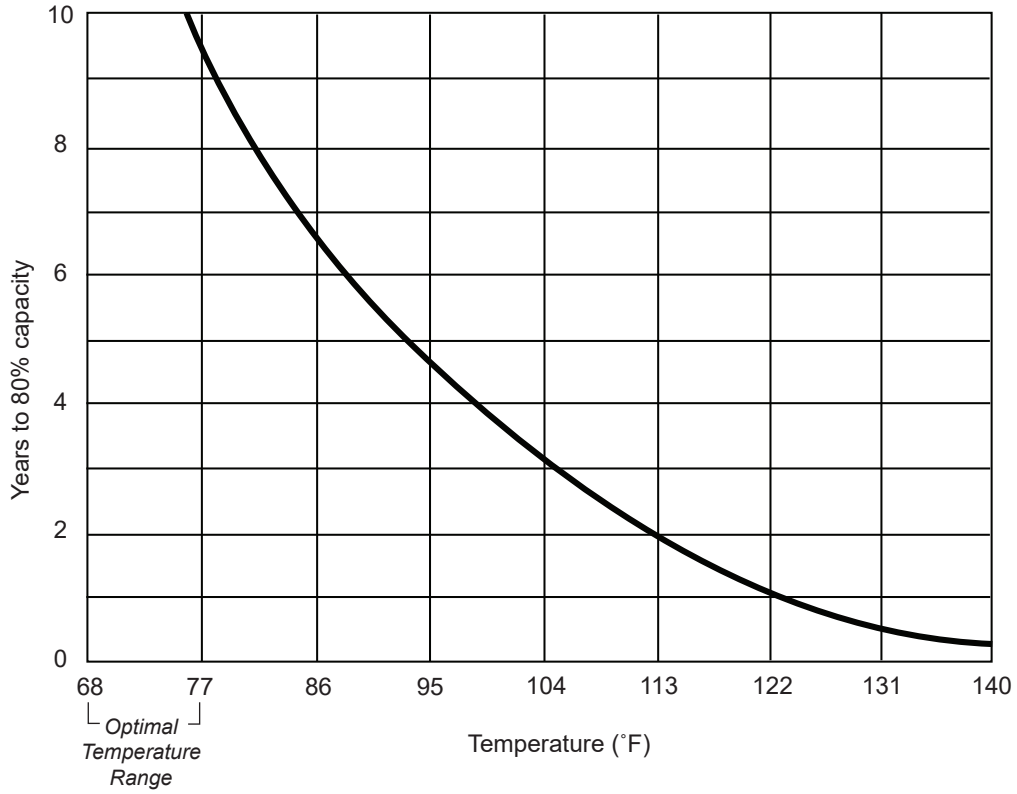

Fig. 2-1, Ambient Temperature vs. Expected Battery Life

Ventilation

The battery enclosure or room must be well-ventilated. Proper ventilation of the batteries will protect against gas buildup. All AlphaCell 210HP batteries are valve-regulated and do not normally emit noticeable amounts of gas. However, in the event of excess gas release, the enclosure must not allow that gas to become concentrated.

WARNING! FIRE HAZARD

Failure to ventilate the battery compartment can result in the buildup of hydrogen gas, which is explosive.

UNDER NO CIRCUMSTANCES SHOULD THE BATTERY BE STORED OR CHARGED IN A SEALED CONTAINER OR ENCLOSURE.

Mounting

Regardless of where the AlphaCell 210HP batteries are mounted (cabinets, racks or other type of enclosure), the positive and negative terminals must be arranged according to the wire diagram. Verify that all contact surfaces are clean before making inter-battery connections and ensure that all batteries are mounted firmly.

Tighten the nuts to the recommended torque value. Lastly, connect the battery end terminals.

Because the electrolyte in the AlphaCell 210HP is immobilized in its separators, the battery may be mounted on its sides without any performance degradation.

2.2 Tools and Equipment

Prior to installing the batteries, verify all recommended tools and equipment, including safety equipment, is available and functional.

The following is a list of the recommended equipment:

- Digital voltmeter
- Infrared temperature sensor
- M6 socket wrench, insulated
- M6 box end wrench, insulated
- Torque wrenches calibrated inch/lbs
- Rubber gloves
- Full face shield
- Safety glasses
- Plastic apron
- Hard hat
- Portable eyewash
- Spill kit, including sodium bicarbonate solution
- Fire extinguisher
- Corrosion inhibiting compound for battery terminals
- Paper towels and/or rags
- Plastic soft bristle brush
- Spare battery terminal hardware and cables
- NO-OX or other corrosion inhibiting compound

Accessories

- Interconnect bar
- Terminal cover
- Hardware kit
- Interconnect cables as needed

2.3 Battery Terminal Assembly Procedure

Typically for Telecom applications, four individual batteries are connected in series to form a higher voltage string of batteries (e.g. 4 each 12 volt batteries connected in series form a 48VDC battery string). Refer to Fig. 2-4 for a 48VDC series connected battery string using 12 volt front access batteries.

WARNING! ELECTRICAL HAZARD

Install an inline fuse on the terminals indicated below *In the event a replacement fuse is needed, contact Alpha Technologies Services, Inc. to order Alpha p/n 460-191-10.*

NOTICE:

A corrosion inhibiting compound such as NO-OX grease should be applied to the battery terminals before installing battery hardware to prevent corrosion.

1. Figures 2-2 and 2-3 show the battery terminal and fuse arrangement for horizontal battery posts.
2. The lugged battery cable should be in direct contact with the battery terminal post.
3. All additional battery cables should be in direct contact with either the battery post or the battery cable lug. The battery cable stack-up should be limited to two battery cables per side.
4. Install Remote Temperature Sensors (RTS) as shown in Fig. 2-3.
5. Torque the fuse mounting hardware to 75 in-lbs (8.5 Nm). For the battery terminals, torque to 44 in-lbs (5.0 Nm).

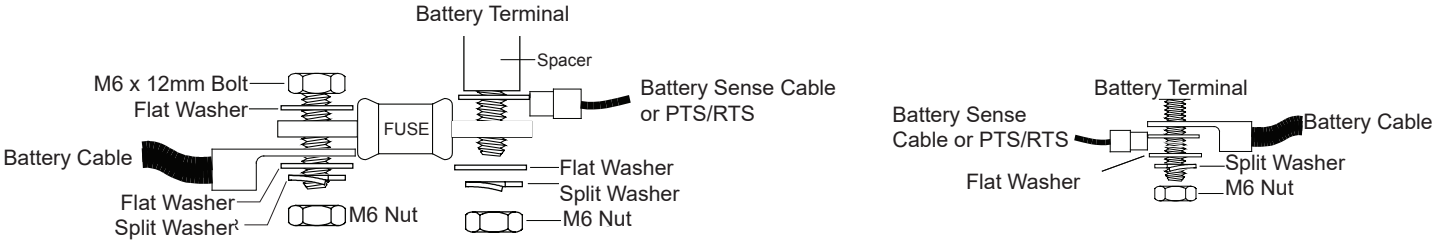

Fig. 2-2, Terminal Stack Up (Fused and Unfused)

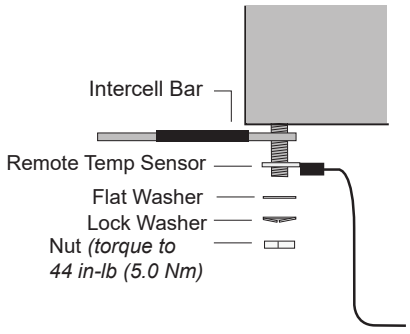

Fig. 2-3, Stack Up for Battery and Remote Temperature Sensor (as applicable)

2.4 Series String Configurations

Batteries are placed in series for additive voltages. Batteries in series are known as a “string”. A string of two AlphaCell 210HP batteries has a nominal voltage of 24 Vdc and can be used for 24-volt loads. A string of four has a nominal voltage of 48 Vdc.

Other voltages are possible. However, batteries in series do not have additive amp-hours.

A single string of any voltage (as shown below) has the same amp-hours as a single battery.

When replacing batteries, a new battery should not be placed in series with old batteries. This will cause severe stress and shorten the life of all batteries. All batteries in a string should be replaced at the same time.

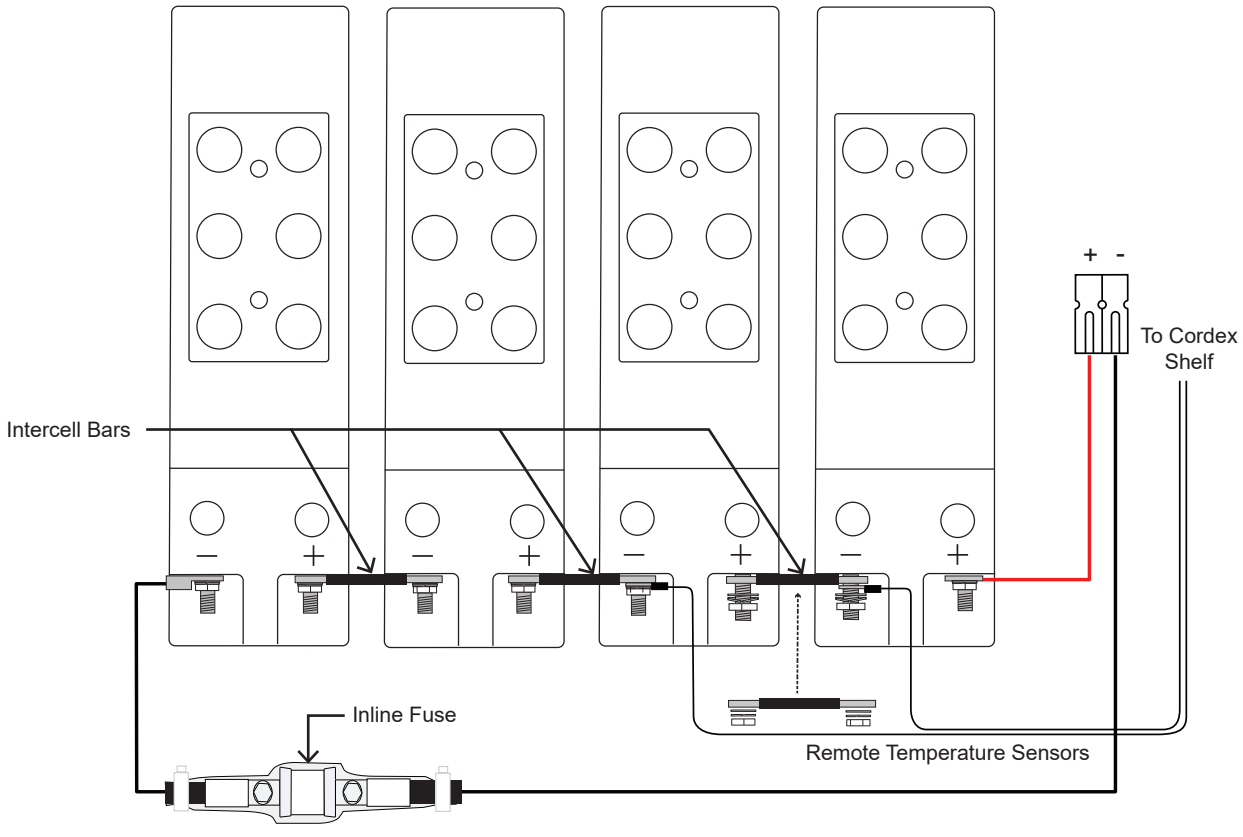

Fig. 2-4, Series String Configuration

2.5 Parallel String Configurations

Batteries are placed in parallel (positive to positive, negative to negative) for additive amp-hour capacity. The parallel configuration shown below are two 4-cell battery strings wired in parallel to provide additive amp-hour capacity at 48Vdc.

NOTICE:

While there are no theoretical limits on the number of parallel battery strings, Alpha recommends no more than five parallel strings per system, especially for cyclic applications. Use caution when designing or building systems with more than three AlphaCell 210HP batteries or strings in parallel. The extra conductors and connections used in larger paralleled systems can lead to unexpected resistances and imbalances between batteries. Without proper precautions, these factors will reduce the system efficiency and shorten the life of all batteries. For systems beyond three strings, contact an Alpha representative.

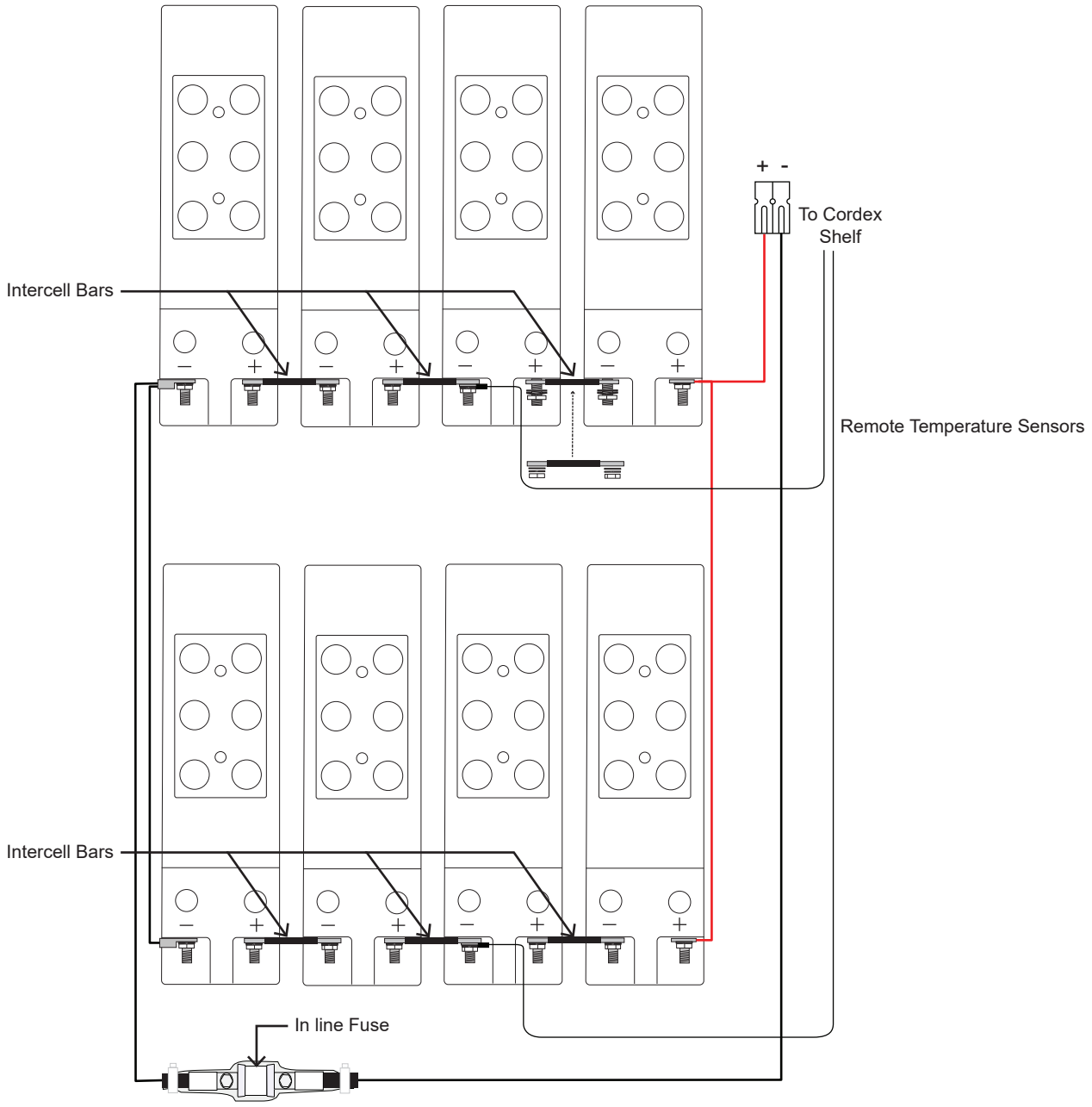

Fig. 2-5, Parallel String Configuration

3.0 Preparing for Maintenance

At minimum, each string must be physically inspected every 6 months. Measurement of electrolyte specific gravity, as well as adding water to individual battery cells, is not necessary. All batteries in the string should be numbered to facilitate recording and analysis of data unique to each unit. Notify anyone affected by the intended maintenance or troubleshooting activity. For tools and required equipment for maintenance, refer to Section 2.2, Tools and Equipment.

4.0 Battery Maintenance Procedure

4.1 Battery Visual Inspection

Every six months the technician should inspect the condition of the batteries for the following:

- General appearance and cleanliness of battery, battery rack and battery area.
- Inspect for contamination by dust.
- Inspect for loose or corroded connections. If terminal hardware is loose, torque to 44 in-lbs (5.0 Nm).
- If necessary, isolate the string/battery and clean with a damp soft cloth. Do not use solvents or scouring powders to clean the batteries.
- Cracks in cell containers or leakage of electrolyte.
- Any evidence of corrosion at cell terminals, connectors or racks.
- Ambient temperature and condition of ventilation equipment.

4.2 Battery Maintenance

After the visual inspection, the technician should do the following and record all readings:

- Use the digital voltmeter and measure the string voltage at the battery terminals. If necessary, adjust the float charge voltage to the correct value.
- Measure individual battery voltages. **Note:** The batteries should be within 5% of the average.
- Measure and record the top center battery's temperature. This is typically the warmest battery in a string.
- Clean the batteries if they have dirt or debris.
- Clean the terminals if they are contaminated with dirt or debris and verify the terminal hardware is free from corrosion. Apply a corrosion inhibiting compound terminals

4.3 Discharging

It is strongly recommended that a low voltage cut-off be included in the battery load circuit to protect the battery from over-discharges. The setting for End of Discharge Voltage (EODV) is dependent on the rate of discharge as shown in the table below. To optimize the AlphaCell 210HP's life, the battery should be disconnected from the load when the appropriate voltage is reached and put back on charge as soon as possible after discharge.

Discharge Rate (Amps)	Suggested Minimum EODV
0.05C10 (C10/20)	10.50V
0.10C10 (C10/10)	10.20V
0.20C10 (C10/5)	10.02V
0.40C10 (C10/2.5)	9.90V
1C10	9.60V
2C10	9.30V
>5C10	9.00V

Table 4-1, Discharge Rates and Suggested EODV

4.4 Recovering Over-Discharged Batteries

If the AlphaCell 210HP is over-discharged and a standard charger is unable to fully recharge the battery, follow the procedure below. Note that after performing Cycle 1, repeat first two steps in the flowchart then proceed to Cycle 2.

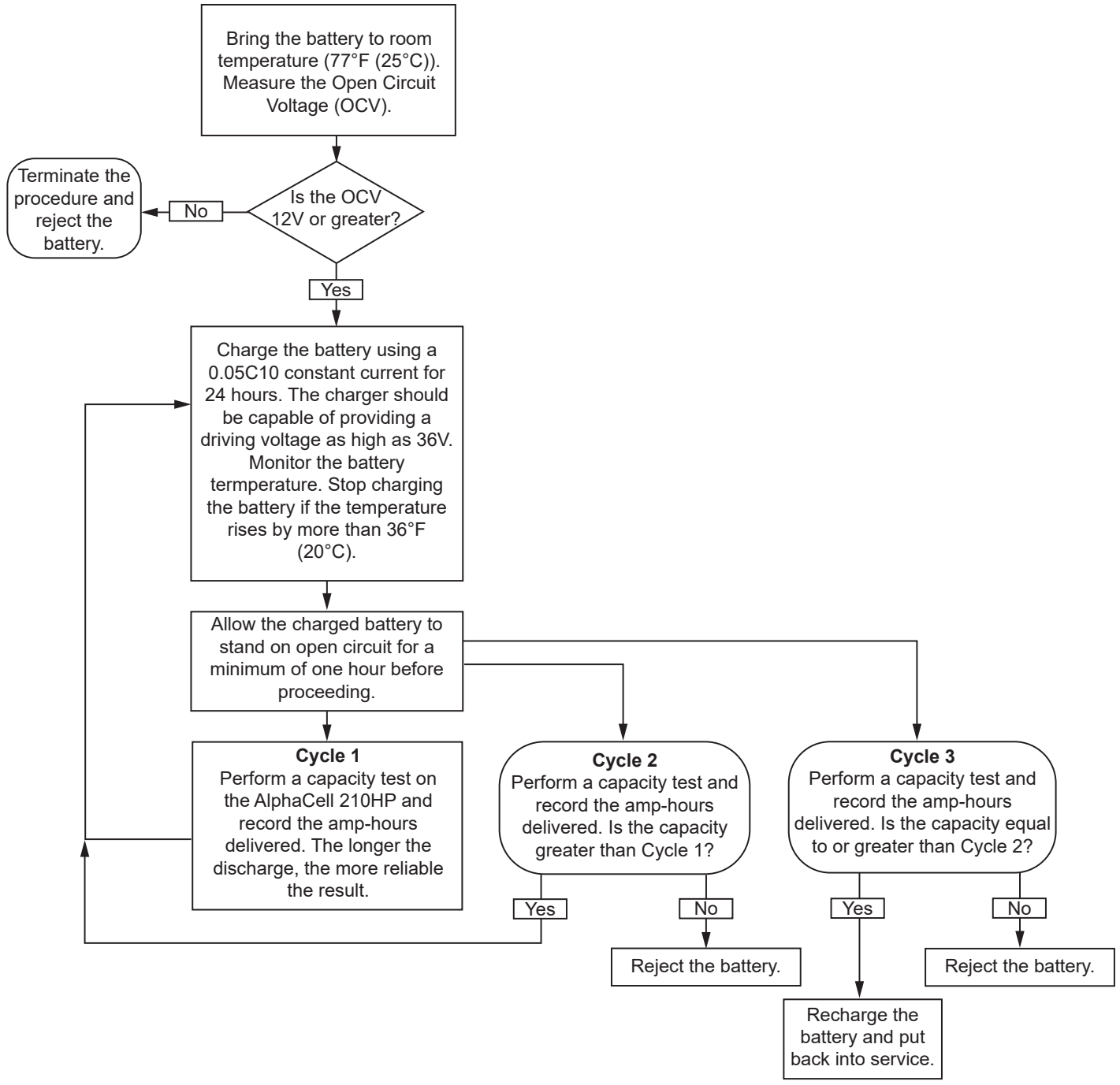

Fig. 4-1, Recovering Over-Discharged Batteries Flowchart

NOTICE:

Deep discharge will produce a premature deterioration of the battery and a noticeable reduction in the life expectancy of the battery.

4.5 Battery End of Life Evaluation Procedures for AlphaCell™ 210HP

To help identify batteries approaching end of life in an operating power system, use the evaluation methods described below. Evaluation Procedure 1 should be performed at each maintenance interval. For batteries not installed in an operating power system, perform Evaluation Procedure 2. For accuracy, tests must be performed on fully charged batteries.

A battery failing any of these tests is defined as a faulty battery. The battery will be replaced under the terms of the warranty if within the defined warranty period.

Evaluation Procedure 1

Float Voltage Test – Measure the float voltage of each battery in the string that is on float charge. Any battery in the string measured at 13.2V or less is a suspect battery and should be further evaluated with the steps below. Any battery below 12.6V should be replaced. The 13.2 and 12.6 voltage values are based on a 77˚F (25˚C) temperature. Adjust the voltage for higher or lower temperatures by 0.0165 volts per battery per degree Fahrenheit. The higher the temperature above 77˚F (25˚C) the lower the voltage will have to be adjusted and vice-versa for temperature below 77˚F (25˚C) (i.e. at a temp of 89˚F (32˚C) would have a corresponding float voltage of 19.10 volts).

Evaluation Procedure 2

24 Hour Open Circuit Test – Measure the open circuit voltage of the suspected battery 24 hours after the battery has come off of float charge. Care must be taken to ensure that the battery is at full state of charge when it is disconnected from the power supply. The battery should exhibit a voltage about 12.6V. A battery below this voltage should be replaced. A fully charged battery below 12.6V is below 70% capacity, but a battery above 12.6V is not necessarily above 70% in capacity. Batteries that have been sitting for extended periods should be recharged after 6 months or when they reach 12.5V (75% capacity), which ever comes first depending on the storage temperature.

4.6 Battery System Float Charging Voltage

Encountering temperature extremes

When you encounter temperature extremes, temperature compensate the float charging voltage. The temperature compensation coefficient is -0.0022 V/C per °F (-0.004 V/C per °C).

For example if the normal battery temperature is 90°F (13° above 77°F) you should reduce the average float charging voltage by 0.0286 V/C (13° x -0.0022 V/C per °F) from 2.25 to 2.22 V.

If the battery operates at cold temperatures, (60°F, 17°F below 77°F, for example), you can increase the charging voltage to improve recharging time.

For example, increase the charging voltage range by -17°F x -0.0022 V/C per degree or 0.0374 V/C.

Under or overcharging

If the battery is undercharged for a period of time during which there are multiple discharges, the battery does not fully recharge after each discharge and provides progressively lower capacity.

Excessive overcharging causes premature aging of the battery and loss of capacity, noted by excessive float current, corrosion of the plate grids, and gassing and drying of the limited amount of electrolyte.

Severe overcharging over extended periods of time can induce a thermal runaway condition. This requires replacing the battery system.

4.7 Charging with a Constant Voltage Regime

To charge the AlphaCell 210HP, a Constant Voltage (CV) routine is the preferred method for charging these batteries. There is no limit on the magnitude of the charge current during a CV charge, and it is able to accept any level of inrush current provided by a constant-voltage charger.

In a float or standby application the CV charger should be set at 13.5V to 13.8V at 77°F (25°C). For a cyclical application, the charge voltage should be set between 14.4V and 15V at 77°F (25°C). In both cases, the linearized temperature compensation factor is ±24mV per battery per °C variation from 77°F (25°C). The higher the temperature, the lower the charge voltage should be and vice versa.

Capacity Returned	Magnitude of Inrush Current		
	0.8C10	1.6C10	3.1C10
60%	44 min.	20 min.	10 min.
80%	57 min.	28 min.	14 min.
100%	1.5 hrs.	50 min.	30 min.

Table 4-2, CV Regime, Inrush Current and Charge Time

Improper Use

CAUTION!

Read all items below. Maintenance should be performed as noted in **Section 4.0, Battery Maintenance Procedure**. Failure to follow these instructions can result in battery damage which is not covered under the AlphaCell 210HP warranty.

Do not exceed the specified absorption voltage when charging any AlphaCell 210HP battery. Excessive voltage could result in battery damage which is not covered under the AlphaCell 210HP warranty.

For any AlphaCell 210HP battery, if the charger settings are too high, this will cause premature aging of the battery, including loss of electrolyte due to gassing. The result will be permanent loss of some battery capacity and decreased battery life. This is also true for battery charging that is not compensated for high temperatures.

“Thermal runaway” can result from high ambient temperatures, charging at higher voltages over extended time, incorrect temperature compensation, or shorted cells. When the buildup of internal heat exceeds the rate of cooling, the battery’s chemical reaction accelerates.

The reaction releases even more heat, which in turn continues to speed up the reaction. Thermal runaway causes severe heat, gassing, lost electrolyte, and cell damage. It usually requires the batteries to be replaced. The process can be halted by turning off the charger. However, if cell damage has occurred, shorted cells may continue to generate heat and gas for some time.

If an AlphaCell 210HP battery is not charged completely (or if the settings are too low), it will not reach 100% SoC. Its total capacity will not be available during the next discharge cycle. This capacity will become progressively less and less over subsequent cycles. Long-term undercharging will result in decreased battery life. This is also true for battery charging that is not compensated for low temperatures.

5.0 Troubleshooting

Problem With	Symptom	Possible Causes	Possible Result	Corrective Actions
Capacity Test Results	Reduced operating time at 77°F (25°C) with smooth voltage decline	Normal life cycle	Eventual failure to support the load followed by potential for shorted cells.	Replace battery system when at 70% of rated capacity or before.
	Reduced operating time at 77°F (25°C) with steep voltage decline or voltage plateaus	Individual low capacity cells	Reversed cells during discharge. Reversed cells will become very hot and will not fully recharge.	Replace the isolated low capacity batteries.
	Excessive initial voltage drop, even to the point of dropping load in the first several seconds.	• Cable gauge too small. • High resistance connections. • Battery is undersized. • Shorted cells.	• Excessive voltage drop. • Cells will become hot, could develop thermal runaway; internal arcing could result in an explosion.	• Run parallel cables or increase gauge of cables. • Clean and reassemble connections. • Add required parallel strings. • Replace isolated units with shorts and evaluate entire string.
Visual Battery Checks	Cover or container crack	Handling or impact damage	Cell dry out or ground fault. Potential internal gas ignition.	Replace damaged unit.
	Cover or container explosion	Ignition of cell internal gasses due to external source, fusing, or internal conductive path or internal spark due to shorting. Potential exists for ill-maintained batteries or those left in service beyond useful life.	• Personal injury and equipment damage at time of explosion. • Failure to support load.	Replace damaged unit and evaluate balance of string.
	Burned area on container	Crack in container wicking electrolyte to grounded rack/ tray. Ground fault.	Could result in • personal hazard due to conductive path to rack. • smoke or battery fire. • thermal runaway.	Clear the ground fault and replace defective unit. Evaluate balance of string.
	Permanently deformed (swollen) container	Thermal runaway possible caused by high temperature environment, overcharging, excessively high recharge current, shorted cells, ground fault, or a combination of these.	Could result in the emission of hydrogen sulfide, detectable as a rotten egg odor, battery fire, and inability to support the load.	Replace the battery system, and correct the items leading to the thermal runaway condition.
	Rotten egg odor	Possible caused by high temperature environment, overcharging, excessively high recharge current, shorted cells, ground fault, or a combination of these.	Odor is a product of thermal runaway.	Replace the battery system and correct items leading to thermal runaway condition.
	Melted grease at terminals	Hot connections due to excessive resistance caused by loose connections, dirty contact surfaces or corrosion within connection.	• Excessive voltage drop perhaps leading to short operating time or damaged terminals. • In extreme case could lead to melted terminal and ignition of the battery cover.	• Clean and reassemble connection if damaged. • Replace batteries with damaged terminals.
	Corrosion at terminals	Possibly electrolyte leaking from battery terminal seal attacking the interunit container.	Increased connection resistance and resulting increase in the connection heating and voltage drop at high rate discharge.	Disassemble connection, clean, coat connecting surfaces and terminal area seal with anti-oxidation grease, and reassemble the connection. If leakage about terminal area is obvious, the battery should be replaced.

Table 5-1, Troubleshooting

5.0 Troubleshooting

Problem With	Symptom	Possible Causes	Possible Result	Corrective Actions
DC Voltage Checks	System float voltage > 2.3V/C average 77°F (25°C)	Charger output set incorrectly.	Overcharging causes excessive gassing and drying out of electrolyte, and contributes to potential thermal runaway.	Reset the charger output voltage to recommended value.
	System float voltage < 2.25V/C average 77°F (25°C)	Charger output set incorrectly.	Undercharging results in gradual loss of operating time and capacity with successive discharge cycles. If persistent, an irreversible level of lead sulfate develops on the plates resulting in a permanent capacity loss.	• Reset the charger output voltage to recommended value. • Equalize battery system from 48 to 72 hours and perform capacity test. If capacity loss is permanent, replace the total battery system.
	DC voltage measured between battery system output terminals and ground (rack/tray) or a ground fault indicated by automatic monitoring equipment.	Damaged container allowing electrolyte to wick out to grounded surface (rack/tray).	• Personnel shock hazard resulting in serious injury or electrocution. • Potential burning of container at damaged area or battery fire.	Determine the source of ground fault and replace battery.
Temperature Checks	Elevated room temperature	Lack of adequate air conditioning or ventilation.	Reduced battery life.	Cool room or accept reduced battery life.
	Elevated battery temp.	• Elevated room temp. • Inadequate cabinet ventilation. • Discharge - charge cycle.	• Reduced battery life. • Reduced life and potential thermal runaway. • Normal if not exceeding 18°F/10°C increase.	• Improve room air conditioning. • Improve cabinet ventilation. • Limit recharge current.
	High current recharge	• High charging voltage. • Shorted cells.	Normal if not exceeding 18°F/10°C increase over ambient.	• Limit recharge current. • Reduce within specifications. • Replace shorted cells and evaluate total string.
Float Charging Current Checks	Float current to string is zero.	A battery or connection in series string is open. Verify via the float voltage check or AC ripple voltage or impedance check of individual batteries.	• Failure to support load. If an internal arc occurs during discharge, can ignite gasses internal to cell. • If there is an open/loose connection in external conductive path, can damage termination under load.	Replace battery with open cell or repair open/loose external connection.
	Float current exceeds 3.0 milliamperes per ampere hour of rated capacity at 77°F(25°C) at float voltage.	• Batteries not fully recharged. • Batteries above 77°F(25°C). • Potentially shorted cells in battery. • Depending on degree, battery entering or in thermal runaway.	• Not at 100% capacity. • Conducive to thermal runaway. • Thermal runaway results in eventual meltdown of battery and potential of hydrogen sulfide emissions and fire.	Determine specific cause; take corrective action.

Table 5-1, Troubleshooting, continued

5.0 Troubleshooting

Problem With	Symptom	Possible Causes	Possible Result	Corrective Actions
Connection Hardware Resistance / Tightness Check	Connection resistance increase 20% or more from original value.	• Repetitive cycles results in heating and cooling of connection, resulting in relaxation of torque, increase in connection resistance. • Contamination within the connection results in corrosion and high terminal resistance.	• Loose connections result in heat damaged or melted terminals during high rate discharge. • Excessive voltage drop during high rate discharge and resulting reduced operating time.	• Re-torque connection as required. • Correct source of contamination, clean contact surface areas, grease contact surfaces with anti-oxidant grease, reassemble.
	Connection hardware tightness is less than the specified "re-torque" value.	Repetitive cycles results in heating and cooling of connection resulting in relaxation of torque and increase in connection resistance.	Loose connections result in heat damaged or melted terminals during high rate discharge.	Re-torque the connection as required.
AC Ripple Voltage Checks	AC ripple (p-p) voltage on system >4% of the value of the DC float voltage.	Poor filtering of charger output.	Excessive AC ripple could cause the battery to cycle at the ripple frequency and result in heating and deterioration of the plate active material.	Improve the charger output filtering.
	Individual battery in string exhibits AC ripple voltage twice that of other typical batteries in string.	Battery with high AC ripple voltage has proportionately higher impedance. Evaluate for performance. Subject battery could have deteriorating conductive path or dry, shorted or open cell.	• Reduced operating time. • Potential conditions could be conducive to thermal runaway.	Verify battery condition. Replace as required.

Table 5-1, Troubleshooting, continued

6.0 Battery Specifications

AlphaCell 210HP Details	
Battery Category	Valve-regulated, lead acid (VRLA)
Battery Technology	Thin Plate Pure Lead-tin (TPPL)
Cells Per Unit	6
Voltage Per Unit	12Vdc
Cycle Life	400 to 80% Depth of Discharge (DOD)
Operating Temperature Range	-40 to 140°F (-40 to 60°C)
Temperature Compensation	±24mV per battery per °C variation from 25°C (77°F).
Float Life @ 2.27 volts/cell Charge	10 years at 77°F (25°C)
Shelf Life @ 77°F (25°C)	18 Months
Float Charge Voltage	13.5V to 13.8V at 77°F (25°C) per 12V unit
Cyclic Charge Voltage	14.4V to 15V at 77°F (25°C)
Max Charge Current	Unlimited with constant voltage
Terminal Hardware Type	M6 terminals
Terminal Hardware Torque	44 in-lbs (5.0 Nm)
Dimensions (L x W x H)	22.57 x 4.92 x 12.46" (561 x 125 x 316.5 mm)
Weight	132.3 lbs (60 kg)
Accessories	Ships with interconnect bars, terminal covers, fuse and hardware kit

Ampere Hour Capacity @ 77°F (25°C)															
End Point Volts/Cell	2 min	5 min	10 min	15 min	20 min	30 min	45 min	1 hr	2 hr	3 hr	4 hr	5 hr	8 hr	10 hr	20 hr
1.50V	33.6	62.4	87.9	102.9	113.1	135.0	148.1	156.3	172.3	181.4	185.9	189.1	199.7	202.8	212.5
1.67V	26.3	53.4	79.3	95.1	106.2	127.7	141.9	150.8	168.4	176.2	181.0	184.3	194.6	197.6	208.4
1.75V	21.4	46.0	70.7	86.5	97.7	119.3	134.3	144.0	163.4	172.2	177.4	181.0	191.5	194.4	203.8
1.85V	15.4	35.7	57.9	72.8	83.8	105.0	121.0	131.6	153.7	163.9	170.0	174.0	184.8	187.6	194.8

Constant Current Discharge Rate in Amps @ 77°F (25°C)																
End Point Volts/Cell	2 min	5 min	10 min	15 min	20 min	30 min	45 min	1 hr	2 hr	3 hr	4 hr	5 hr	8 hr	10 hr	20 hr	24 hr
1.50V	1009.4	749.4	527.5	411.5	339.3	270.0	197.5	156.3	86.2	60.5	46.5	37.8	25.0	20.3	10.6	8.9
1.67V	787.6	640.8	475.6	380.4	318.5	255.4	189.1	150.8	84.2	58.7	45.2	36.9	24.3	19.8	10.4	8.8
1.75V	643.1	552.1	424.4	345.8	293.0	238.6	179.1	144.0	81.7	57.4	44.3	36.2	23.9	19.4	10.2	8.6
1.85V	462.1	428.1	347.2	291.2	251.5	210.0	161.3	131.6	76.8	54.6	42.5	34.8	23.1	18.8	9.7	8.2

Constant Power Discharge Rate in Watts @ 77°F (25°C)																
End Point Volts/Cell	2 min	5 min	10 min	15 min	20 min	30 min	45 min	1 hr	2 hr	3 hr	4 hr	5 hr	8 hr	10 hr	20 hr	24 hr
1.50V	9185	7426	5513	4463	3748	3020	2248	1799	1013	718	555	453	300	244	128	108
1.67V	7917	6726	5148	4189	3547	2888	2169	1746	993	699	541	442	293	238	125	105
1.75V	6737	5965	4694	3875	3313	2730	2073	1679	968	685	531	435	289	235	123	104
1.85V	5069	4806	3961	3352	2913	2452	1897	1555	918	656	512	420	280	227	118	99

Constant Power Discharge Rate in Watts/Cell @ 77°F (25°C)																
End Point Volts/Cell	2 min	5 min	10 min	15 min	20 min	30 min	45 min	1 hr	2 hr	3 hr	4 hr	5 hr	8 hr	10 hr	20 hr	24 hr
1.50V	1530.83.	1237.67	918.83	743.83	624.67	503.33	374.67	299.83	168.83	119.67	92.5	75.5	50	40.67	21.33	18
1.67V	1319.5	1121	858	698.17	591.17	481.33	361.5	291	165.5	116.5	90.17	73.67	48.83	39.67	20.83	17.56
1.75V	1122.83	994.17	782.33	645.83	552.17	455	345.5	279.83	161.33	114.17	88.5	72.5	48.17	39.17	20.5	17.28
1.85V	844.83	801	660.17	558.67	485.5	408.67	316.17	259.17	153	109.33	85.33	70	46.67	37.83	19.67	16.57

Table 6-1, Battery Specifications

7.0 Alpha Cordex CXC HP System Controller Settings

The table below provides a reference to the default values and ranges for 12V, 24V and 48V systems in the Cordex CXC HP System Controller. For more detail on configuring the Cordex or to download the Cordex CXC HP System Controller Software Manual *(Alpha p/n 0350058-J0)*, visit www.alpha.com.

12V	Default	Minimum	Maximum
Allowed Voltage Range	---	10.5	15.0
Float Voltage	13.5	11.875	14.55
Equalize Voltage	13.75	12.45	15.05
Boost Voltage	13.75	12.45	15.05
Rectifier - Minimum Test Voltage	11.0	---	---
Safe Voltage	12.85	11.5	14.0
Over Voltage Protection	14.25	12.125	15.75
Absorption Arming Voltage	13.75	12.45	14.75
Temp Comp Max Voltage	13.875	---	14.5
Temp Comp Min Voltage	13.125	11.875	---
Battery String Number of Cells	6	1	200
Temp Comp Voltage Warning	0.25	0	0.25
Battery Test Termination Voltage	11.125	11.125	15.0
Output Voltage High Alarm	13.875	10.50	15.00
Output Voltage Very High Alarm	14.125	10.50	15.00
Output Voltage Low Alarm	12.0	10.50	15.00
Output Voltage Very Low Alarm	11.625	9.00	15.00
24V			
Allowed Voltage Range	---	21.0	30.0
Float Voltage	27.0	23.75	29.1
Equalize Voltage	27.5	24.9	30.10
Boost Voltage	27.5	24.9	30.10
Rectifier - Minimum Test Voltage	22.0	---	---
Safe Voltage	25.7	23.0	28.0
Over Voltage Protection	28.5	24.25	31.5
Absorption Voltage	27.5	24.9	29.5
Absorption Arming Voltage	24.0	21.0	26.5
Temp Comp Max Voltage	27.75	---	29
Temp Comp Min Voltage	26.25	23.75	---
Battery String Number of Cells	12	1	200
Temp Comp Voltage Warning	0.5	0	0.5
Battery Test Termination Voltage	22.25	22.25	26.0
Output Voltage High Alarm	27.75	21.00	30.00
Output Voltage Very High Alarm	28.25	21.00	30.00
Output Voltage Low Alarm	24.0	21.00	30.00
Output Voltage Very Low Alarm	23.25	18.00	30.00

Table 7-1, Cordex CXC HP System Controller Default Values and Ranges

7.0 Alpha Cordex CXC HP System Controller Settings

48V	Default	Minimum	Maximum
Allowed Voltage Range	---	42.0	60.0
Float Voltage	54.0	47.5	58.2
Equalize Voltage	55.0	49.8	60.2
Boost Voltage	55.0	49.8	60.2
Rectifier - Minimum Test Voltage	44.0	---	---
Safe Voltage	51.4	46.0	56.0
Over Voltage Protection	57.0	48.5	63.00
Absorption Voltage	55.0	49.8	59.0
Absorption Arming Voltage	48.0	42.0	53.0
Temp Comp Max Voltage	55.5	---	58.0
Temp Comp Min Voltage	52.5	47.5	---
Battery String Number of Cells	24	1	200
Temp Comp Voltage Warning	1.0	0	1.0
Battery Test Termination Voltage	44.5	44.5	52.0
Output Voltage High Alarm	55.5	42.00	60.00
Output Voltage Very High Alarm	56.5	42.00	60.00
Output Voltage Low Alarm	48.0	42.00	60.00
Output Voltage Very Low Alarm	46.5	36.00	60.00

Table 7-1, Cordex CXC HP System Controller Default Values and Ranges, continued

8.0 Warranty and Return Information

8.1 AlphaCell™ 210HP Limited Warranty

Alpha Technologies Services, Inc. (“Alpha”) warrants the AlphaCell™ 210HP battery ("Battery") against defective materials and workmanship for a period of five (5) years in the USA and Canada and four (4) years rest of world in worldwide stable grid float service applications as laid out in the terms below from the date the Battery was manufactured.

A. If initial physical inspection identifies flaws in material or workmanship that would impair life of the Battery, as defined by this warranty, or product performance, as defined by Alpha’s electrical and physical specifications as published at the time of shipment and these flaws are not due to transportation damage or installation abuse;

OR

B. If on initial “Acceptance Test”, as defined in IEEE Std. 1188, “IEEE Recommended Practice for Maintenance, Testing, and Replacement of Valve Regulated Lead Acid (VRLA) Batteries for Stationary Applications”, the properly installed Battery and/or string fails to meet the published performance ratings* per Alpha’s latest published catalog data at the time of shipment;
To make a warranty claim in the event of either A or B above, contact the nearest Alpha sales representative. You will be instructed to either a) return the battery to an Alpha facility or service center location, FOB Destination-Freight Prepaid, for examination, or b) wait until an Alpha representative arrives at the site to inspect the Battery.

If Alpha determines in its sole discretion that the Battery is physically or electrically unsound due to defective materials or workmanship on the part of Alpha, the defective Battery(ies) will be repaired or replaced, at the option, of Alpha without charge to the original purchaser (“User”) for replacement materials. However, costs of replacement installation including but not limited to equipment, travel expenses of Alpha representatives, and costs of material transportation expenses shall be borne by the User. The replacement battery shall only complete the remaining unused portion of the original warranty of the replaced Battery.
* Published performance ratings. Initial capacity shall be a minimum of 90 percent of the rated string capacity upon shipment per IEEE-1188.

EXCLUSIONS AND LIMITATIONS

1. The original purchaser (“User”) shall give freshening charges to the Battery as per Alpha recommendations which include an OCV audit every six (6) months until final installation. Refer to the current guidelines and/or instructions published by Alpha for maximum storage intervals and charging.

2. The Battery must be charged, installed and maintained in accordance with the current guidelines and/or instructions published by Alpha. Failure to do so will invalidate the warranty, at the sole discretion of Alpha.

3. At least once every six (6) months, the User must take readings and record information per the current installation/maintenance instructions published by Alpha. These records must be maintained for warranty claim purposes. Failure to follow the current guidelines and/or instructions published by Alpha and/or if warranty records are not kept, will invalidate the warranty, at the sole discretion of Alpha.

4. Movement of a Battery from the original point of installation shall immediately void this warranty, except with the expressed written consent from Alpha headquarters in Bellingham, WA.

5. This warranty shall be void for a Battery shipped or placed in service outside the United States and Canada, except with the expressed written consent from Alpha headquarters in Bellingham, WA.

6. This warranty applies to the User and is non-transferrable, except with the expressed written consent from Alpha headquarters in Bellingham, WA.

7. This warranty is invalid if the Battery is subjected to misuse, physical damage or abuse other than normal wear and tear.

8. Repair or attempted repair of the Battery by anyone other than an authorized Alpha representative shall void this warranty.

9. Alpha, at its sole discretion, may require proof of purchase consisting of a copy of the original product invoice.

10. The acceptance of a Battery shipped to Alpha shall not be deemed an admission that the Battery so shipped is defective. The Battery shipped back to Alpha, shall, in Alpha’s sole discretion, become Alpha’s sole property.

THIS LIMITED WARRANTY IS IN LIEU OF, AND ALPHA DISCLAIMS AND EXCLUDES ALL OTHER WARRANTIES, STATUTORY, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. ALPHA’S EXCLUSIVE LIABILITY FOR BREACH OF WARRANTY SHALL BE TO REPAIR OR REPLACE THE BATTERY AT ALPHA’S SOLE DISCRETION WITHIN THE EFFECTIVE WARRANTY PERIOD. IN NO EVENT SHALL ALPHA BE LIABLE FOR ANY LOSS OR DAMAGES OF ANY OTHER KIND, WHETHER DIRECT, INCIDENTAL, CONSEQUENTIAL, EXEMPLARY, SPECIAL OR OTHERWISE. NOR SHALL ALPHA BE LIABLE FOR ANY REMOVAL OR INSTALLATION EXPENSE, OR THE LOSS OF TIME OR PROFITS. USER ASSUMES RESPONSIBILITY FOR ALL PERSONAL INJURY AND PROPERTY DAMAGE RESULTING FROM THE HANDLING, POSSESSION OR USE OF THE BATTERY. IN NO EVENT SHALL THE LIABILITY OF ALPHA FOR ANY AND ALL CLAIMS EXCEED THE PURCHASE PRICE OF THE BATTERY.

Some countries and/or states do not allow limitations on how long an implied warranty lasts or the exclusion or limitation of incidental or consequential damages, so the above limitations may not apply to User. This warranty gives the User specific legal rights, which may vary from country to country and/or state to state. This warranty shall be governed by and interpreted in accordance with the laws of the Commonwealth of Pennsylvania without regard to Pennsylvania conflicts of laws rules. The United Nations Convention on Contracts for the International Sale of Goods signed in Vienna in 1980 shall not apply to this warranty. This warranty is understood to be the exclusive agreement between the parties relating to the subject matter hereof. No employee or representative of Alpha is authorized to make any warranty in addition to those made in this agreement.

The table below indicates the warranty periods for AlphaCell 210HP Batteries used with Alpha approved power supplies and enclosures.

Model	Warranty USA/Canada	Warranty World Wide Stable Grid
210HP	5 years	4 years

Contact Alpha Technologies Services, Inc. at 1-800-322-5742 for excluded countries and cycling applications.

Table 8-1, Warranty Periods for AlphaCell 210HP Batteries

8.2 Battery Maintenance Report for Return Authorizations

Contact your Alpha Customer Service representative for assistance in processing your AlphaCell 210HP warranty claim.

Alpha Technical Support 1-800-863-3364

This form, in conjunction with Alpha's Battery Evaluation Procedure is intended as a method of collecting data critical to the efficient processing of your warranty battery claims. Record battery float voltage while the battery is still connected to the system. Record battery open circuit voltage (OCV) 24 hours following removal from the system. Describe the problem encountered with the battery as compared to the remaining batteries in the battery string. The ZRE# will be provided after the request has been submitted to Alpha for processing.

Customer Name/Company Name _____

Customer Address Line 1 _____

Customer Address Line 2 _____

Customer Phone _____

Customer Email _____

Battery Model	Initial Install Date	MFR. Date Code (4-Digit Code on Top Label)	Battery Temperature (At Time of Measurement)	Battery Temperature	Evaluation Procedure 1 (Performed Live in Field)		OR	Evaluation Procedure 2 (Performed in Warehouse)	
					V in Float (No Load)	Conductance (Siemens)		V after 24-hr OCV	Conductance (Siemens)

an EnerSys company

746-680-B13-001, Rev. A (12/2019)