



VALEN ENLIFEN LITHIUM INSTALLATION AND OPERATING INSTRUCTIONS

**TO BE INSTALLED BY A SUITABLY QUALIFIED
ELECTRICIAN ONLY**

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**A family
owned
Australian
business**

General Information

Valen ENLiFEN PO4 Lithium Phosphate batteries are only to be used in conjunction with the below. Please ensure all instructions are read prior to battery use and warnings are adhered to during the installation and operation of these batteries. The lithium (LiFePO4) battery cells and modern digital embedded, computerised technologies culminate in an energy storage solution that has many unique advantages. This type of battery has no special ventilation or handling requirements. Since the electrolyte in the battery is immobilised, the batteries are considered dry batteries and can be handled and shipped accordingly.

PRECAUTIONS!

This battery has a high power output and, if used incorrectly, could hurt or kill you. Not all is known about the hazards of the chemicals used and caution should be exercised should these become exposed when a casing is compromised.

1. Although the unit is relatively light in weight, which is a feature of lithium batteries, the battery is capable of delivering large amounts of energy.
2. Do not short positive and negative terminals.
3. Disconnect all power before attempting to install, remove or perform maintenance work.
4. Ensure the terminals are insulated before storing and transporting the batteries.
5. When on charge, float voltages must be measured. Be particularly careful because shorting a battery at this time can cause severe equipment failure and personal harm.
6. Do not tamper with any parts of the battery including cover, terminal covers, etc.
7. Keep batteries clean and dry.
8. Do not use cleaners or solvents on any part of the battery.
9. Do not allow excessive dust to accumulate on the battery or cabling.
10. Keep battery connectors clean and tight. A loose connection can reduce battery standby time and has been known to cause fire.
11. Multi-cell systems can attain lethal voltages. Remove all jewellery before working on batteries. Cover all tools with appropriate electrical insulation to minimise the possibility of shorting a battery during installation. Never lay tools or other metallic objects on batteries or near the terminals.
12. Do not allow construction work near batteries.
13. Protect batteries from naked flame and avoid any impacts,
14. Always use a suitable lithium battery charger with the correct charging profile when charging lithium batteries

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 VALEN before installing the batteries.

Tips:

- Using the battery correctly along with the below tips will extend the batteries life and prevent it from premature failure.
- If the batteries BMS Low Voltage Disconnects cuts out, remove the load and recharge as soon as possible. To prevent your system from shutting down, it is recommended to use an LVD on the load output. This will allow the load to cut off before the BMS cuts the battery off.
- If the battery goes into its over-discharge protection voltage range, ensure the battery is recharged within 7days.
- For optimum life, batteries in storage should be recharged periodically.
- The ideal storage temperature is 25°C.
- Batteries should be fully charged before being stored.
- Keep lithium batteries away from high temperatures.
- If the battery shows any signs of deformation, heat or emits smells, immediately discontinue use and remove it from the application

Section 2

Receipt of Equipment

2.1 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 (take photographs) any damage on the delivery receipt before signing. If any damage is found, contact the carrier immediately, request an inspection and file a damage claim.

2.2 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 the right of reimbursement for hidden damage.

2.3 Prior to Installation

Prior to installation always inspect the battery, casing and connections. Ensure it's all in good working order. Check the OCV and ensure the battery is charged.

2.3.1 Installation with multiple units

Prior to installation of multiple units in one system, check their OCV and ensure they're all within 0.2VDC of each other. This is to avoid high in or out rush currents which could arise from different states of charge over multiple batteries.

Storage

3.1 General

- Do not store batteries outside, exposed to the elements. Store indoors in a cool, dry location.
- Do not store batteries in temperatures above 40°C. The recommended storage temperature is 20°C 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. Special precaution needs to be taken around the terminal. Damage in the terminal area may expose the battery voltage.

3.2 Short Term Storage

If the batteries are to be stored for 9 months or less at 20°C, before being put into service, nothing needs to be done at this time. If the batteries are to be stored for longer than 9 months, at temperatures greater than 20°C, or installation is delayed beyond the expected time, a storage charge may be required. A storage charge is an equalisation charge applied to a battery that is stored in an open circuit (not float charging) condition.

If the storage temperature is 5°C to 30°C, VALEN ENLiFEN LiFePO4 Batteries must be charged at least every 6 months while in storage. If stored at ambient temperatures above 30°C, charge the batteries every 4 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 4

General Installation Procedures

CAUTION! Before attempting to install VALEN ENLiFEN Batteries, study this section and the section on safety thoroughly. Failure to do so could result in personal injury and battery or equipment damage.

4.1 Battery Location

4.1.1 Temperature

Battery location is very important in determining the life and performance of the battery. The ideal environment would be a dry, indoors, temperature-regulated area. The ideal operational temperature is 20°C. Operation at temperatures below this will result in a loss of battery performance and may result in a larger, more costly battery being needed. Storage at temperatures above 60°C will result in loss of battery operation life.

4.1.2 Temperature Variation

Maintaining temperature balance across the string is very important for maximum battery life. Excessive temperature variation will result in the need for equalisation and will shorten battery life. Sources of battery temperature variation can be the 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 minimise temperature variations.

4.1.3 Ventilation

Proper ventilation of VALEN ENLiFEN Batteries is important for two reasons:

1. To minimise battery temperature variations and
2. To reduce the possibility of prematurely triggering the over-temperature sensor.

4.1.3.1 Ventilation & Battery Temp. Variation

Charging and discharging VALEN ENLiFEN Batteries gives off a small amount of heat. Proper ventilation is important to remove this heat and to prevent temperature differences from arising in the enclosure. If the VALEN ENLiFEN Batteries are installed in a client's own enclosure, it should be designed to allow unobstructed air circulation and prevent temperature build-up. Sufficient air circulation should be present to prevent temperature-layering effects. In an improperly designed room, there can easily be a 5°C difference in temperature between the floor and the ceiling.

4.1.3.2 Gassing

Unlike VRLA batteries, VALEN ENLiFEN Batteries do **NOT** emit any gas during normal charging and discharging. However, ensure some air exchange is present in the ventilation.

4.1.4 Floor Loading

Whilst this is not quite as severe a problem as with VRLA batteries, before installing the batteries, it should be ascertained that the floor can 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 and cables. It is the responsibility of the installer to ensure adequate floor load loading capabilities.

4.2 Seismic Considerations

VALEN ENLiFEN Batteries are capable of withstanding seismic events of UBC Zone 4 magnitude when properly installed in a suitably designed cabinet or rack. When the seismic capability is desired, suitable floor anchoring should be provided. Proper floor anchoring is the responsibility of the installer. Ensure that the anchors used are of sufficient strength to withstand the maximum seismic load foreseeably.

4.3 Unpacking

VALEN ENLiFEN Batteries are shipped on pallets with cells/modules in the vertical position. All accessories needed for installation and use are packed in boxes and shipped on top of the modules or a separate pallet. Unpack all items carefully and note the quantities received.

4.4 Installation

CAUTION! Remove all jewellery before installing the connectors on the batteries. Ensure that all tools are correctly insulated to prevent shorting. Do not reach or lean across batteries. Remember, hazardous voltages may be present. Be aware of what you are touching at all times. Do not rush, take your time.



4.4.1 General

Ensure that sufficient space is available for handling and placement of the modules. Do not place the VALEN ENLiFEN Batteries near a source of heat, in direct sunlight or where the module may be subject to condensation or water spray. When connected, check the battery voltage. Check the cell voltages and record them with the module ID.

4.5 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 1 thoroughly before working on the battery. Make sure that all terminals and interconnects are clean and connecting bolts are tight. Ensure all plugs, especially the ones carrying the main power, are securely plugged in and these are not under stress which could cause them to come loose at a later date.

4.5.1 Cabling Recommendations

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 drops. 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 20-30mV of voltage drop/metre of the cable run. As an example, if it is 10m from the battery to the load, the cable should be sized to allow no more than $2 \times 10 \times .030 = 0.6$ V volt drop. To help select cable sizes for load connections, the following table should be consulted:

US CABLE SIZE	MM ²	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
250MCM	126.7	221
350MCM	177.4	309
400MCM	202.4	353

Use 1.74 amps/mm² for other cable sizes

4.5.2 Terminal Preparation

Gently clean the contact surface of the terminals with a brass bristle brush or a Scotch Brite pad.

CAUTION! Use extreme care not to short the battery connections. VALEN Batteries are capable of very high short circuit currents.

Before the final tightening of the connections, visually check that the connections are correct and in the required sequence. See section 4.5.4 for the procedure on checking string voltage.

4.5.4 Voltage Checks

Visually check that all connections are properly made (positive to negative) and are tight. Measure module voltage, check that this is between 11.8V-13.8V.

CAUTION! High voltage may be present.

If the voltage of a module is not between these values, contact your VALEN representative for further instructions.

4.5.5 Battery to Charger Connection

Ensure that the charger is disconnected from the power line. If a battery disconnect is installed, open it.

NOTE! 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.

4.5.6 Paralleling of Batteries

When greater capacity is desired than available from a single cell or string, paralleling of batteries becomes necessary. Batteries must be properly paralleled 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 from the load cables, uniform temperature between the strings and equal strings of batteries. Do not parallel other batteries with VALEN 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 5

Operation

5.1 Charging the Valen ENLiFEN Batteries

The VALEN ENLiFEN batteries must be charged with a suitable battery charger or Solar Controller that has a lithium charging profile. Charging voltages and charge current should be limited to that of the BMS current rating, which can be found on the batteries specification sheet.

Maintenance & Record

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

6.1 General Maintenance

General maintenance of the battery means keeping the battery and surrounding area clean and dry. Since VALEN ENLiFEN Batteries are of low maintenance design, there is no addition of water or specific gravity checks needed for the life of the battery.

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 1kg of baking soda in 4L 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.

6.2.1 Installation Records

When the battery is first received, record:

- Date of receipt
- Condition of the battery
- Open circuit voltage of each battery
- Date of installation
- Original purchase order number
- Installer(s)
- Equalisation time and voltage
- Any unusual storage conditions
- Individual battery float voltages
- Ambient temperature
- Float current
- Battery temperature
- String float voltage (Where installed in multiples)

6.2.2 Maintenance Records

Twice per year, record the following:

- Battery float voltages
- String voltage
- Float current
- Ambient temperature
- Battery temperature

Remember, these records are mandatory for any warranty claim on the battery.

Section 7

Capacity Testing

7.1 General

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

1. A rating test discharge – the intention here is to determine the percent of battery capacity as compared to the rated capacity. This is typically an 8hour 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 rating 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 with the ampere-hour capacity of the battery calculated by multiplying 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 backup. 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.

7.2 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 charge for at least one week, re-attach the charger, then do the test after a week of the battery being on charge.
2. Prepare the load bank or test the 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 15 blocs.

For further technical support, please contact VALEN on the below details.



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