I&O Manual

Valen GEL 6-12V Monobloc Batteries

Version: 6.0

TO BE INSTALLED BY A SUITABLY QUALIFIED ELECTRICIAN ONLY

VALEN Power

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SECTION 1 GENERAL INFORMATION

1.1 VALEN GEL 6-12V Battery

The VALEN GEL Battery is a Valve Regulated Lead Acid recombinant battery designed for stationary applications. The VALEN GEL Battery uses Gelled Electrolyte technology. This type of battery gas no special ventilation or handling requirements. Since the electrolyte in the battery is immobilised, the batteries are considered dry batteries can be handled and shipped accordingly.

SECTION 2 SAFETY INFORMATION

2.1 General Information

Lead-acid batteries require care in installation and maintenance. Unsafe installation or maintenance procedures can cause severe injury or death. Electrical shock or burns, acid burns and fire can result if proper safety precautions are not followed. The following precautions apply to all battery installation and maintenance work. For more information, see the following sections:

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

2.2 Sulphuric Acid

The VALEN GEL Battery is lead-acid battery and contains sulphuric acid in a diluted form. Since the electrolyte is immobilised, in the event of case rupture, no liquid acid will leak or run from the battery. However, if the internal components of the battery are touched or handled, contact with the acid will result.

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

2.3 Gassing

All lead-acid batteries emit some gases during charging and float operation. Conventional flooded batteries release all the gases produced to the environment whereas valve-regulated batteries recombine most of the gases internally, releasing very little to the environment.
Compared to a flooded battery of equal capWacity, a VALEN GEL Battery releases a gas volume of 1% or less than the flooded battery. Due to this characteristic, no special ventilation is required under normal usage conditions. Since some gas is released from lead-acid batteries, never charge or use batteries in an unventilated space or container. This gas consists of mostly hydrogen gas and can explode if ignited in a confined area or space. Keep sparks, flame or any other ignition source (including smoking materials) away from batteries.
CAUTION! Hydrogen gas can explode and cause serious injuries and fire. Do not allow any flame or ignition source near batteries. Always allow some ventilation around operating batteries. Contact VALEN if there are any questions regarding gassing or ventilation.

2.4 Electrical Shock

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

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

SECTION 3 RECEIPT OF EQUIPMENT

3.1 Delivery Inspection

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

3.2 Hidden Damage

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

SECTION 4 STORAGE

4.1 General

Do not store batteries outside, exposed to the elements. Store indoors in a cool, dry location. Do not store batteries in temperatures over 30°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.

4.2 Short Term Storage

If the batteries are to be stored for 9 months or less at 20°C, before being put into service, nothing need 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 expected time, a storage charge may be required. A storage charge is an equalisation charge applied to a battery that is stored in open circuit (not float charging) condition. See section 6.5 for details. If the storage temperature is 20°C or less, VALEN GEL Batteries must be charged at least every 9 months while in storage. For every 8°C increase above 20°C, the storage time between charges is cut in half. Therefore, at 28°C the max. storage time is 4.5 months. At 25°C the max. storage time would be 5-6 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. If can also void the battery's warranty. Keep careful records of battery storage time and handling.

SECTION 5 INSTALLATION PROCEDURES

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

5.1 Battery Location

5.1.1 Temperature

Battery location is very important in determining life and performance of the battery. The ideal environment would be a dry, indoors temperature regulated area. The ideal operational temperature is 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. Operation at temperatures above 20°C will result in loss of battery operation life. For every 8°C rise in battery temperature above 20°C, the life of the battery will be cut in half. For example, the VALEN GEL Battery is designed for a 10-year float service life at 20°C. If the battery were to be continuously operated at 28°C, the life expectancy would be halved.

5.1.2 Temperature Variation

Maintaining temperature balance across the string is very important for max. battery life. The difference between the maximum and minimum

bloc temperature in a series string can be no more than 3°C. Excessive temperature variation will result in the need for equalisation and will shorten battery life. Sources of battery temperature variation can be placement of the battery system near a heat source such as radiators, power equipment, windows or heating vents. Air conditioning vents can also cause temperature variations. It is recommended that the battery location be designed, engineered and monitored to minimise temperature variations.

5.1.3 Ventilation

Proper ventilation of VALEN GEL Batteries is very important for two reasons:

1. To minimise battery temperature variations,
2. To minimise build-up of potentially explosive hydrogen gas.

5.1.3.1 Battery Temperature Variation

Recombinant batteries such as VALEN GEL Batteries give off a small amount of heat during charging and float operations. Proper ventilation is important to remove this heat and to prevent temperature differences from arising in the string. If the batteries are installed in a cabinet, it should be designed to allow unobstructed air circulation and prevent temperature build-up. Use angle-iron support rails instead of shelves. If the batteries are on racks, sufficient air circulation should be present to prevent temperature layering effects. In an improperly designed room, there can easily be a 5°C difference in temperature existing in a series string, it will result in a need for equalisation and in reduced battery life.

5.1.3.2 Ventilation & Gassing

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

CAUTION! Hydrogen gas can be explosive. Never install batteries in an airtight enclosure. Ventilation must be provided to remote this hydrogen gas. Allow about 1L/hour/battery of air exchange to prevent hydrogen accumulation.

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

5.1.4 Floor Loading

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

5.2 Seismic Considerations

VALEN GEL Batteries are capable of withstanding seismic events of UBC Zone 4 magnitude when properly installed in a suitably designed cabinet or rack. When seismic capability is desired, suitable floor anchoring should be provided. Proper floor anchoring is the responsibility of the installer.

5.3 Installation - Cabinets

When installing VALEN GEL Batteries in cabinets, follow the recommendations of section 5.1.3.1 regarding cabinet ventilation. Ensure that the batteries are electrically insulated from the cabinet frame. Standard battery spacing is 12mm min. between battery blocs. If the cabinets are to be seismic rated, the batteries must be firmly strapped or otherwise attached to the cabinet to prevent battery shifting during a seismic event. Proper installation is the responsibility of the installer.

5.4 Installation - Racks

5.4.1 Existing Racks

When VALEN GEL Batteries are to be installed in existing racks, ensure that the racks are:

1. Proper size for the intended battery
2. Has sufficient weight carrying capability for the intended battery, including seismic considerations, and of sufficient size to hold the no. of blocs (plus the 12mm needed between blocs) for the complete system.

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

5.4.2 New Racks

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

5.4.3 Installation

Determine the location of the positive and negative terminals of the battery with respect to the rack location. When placing batteries on the rack, alternate the polarities for proper intercell connection. Standard spacing between blocs is 12mm. Gently position the batteries on the rack.

5.5 Electrical Connections

Proper battery electrical connections are very important for the best battery performance and utility. Improper battery connections can cause a loss of standby time or even a battery fire. Follow the electrical connection instructions carefully and review section 2.4 thoroughly before working on the battery.
CAUTION! Remove all jewellery before installing the connectors on the batteries. Ensure that all tools are insulated with vinyl electrical tape to prevent shorting. Do not reach or lean across batteries on step present. Be aware of what you are touching at all times.

5.5.1 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 drop. The smaller the cable wire diameter, the greater the voltage drop. Therefore, to get the best performance from the battery short, heavy cables are recommended. Do not size the cables based on current carrying capacity only. A general rule of thumb is to allow no more than 1 30mV of voltage drop per metre of 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 x 10 x 0.030 = 0.3V drop. Interbloc cables are provided, in order to help select cable sizes for inter-tier and load connections, the following table should be consulted:

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
250 MCM	126.7	221
350 MCM	177.4	309
400 MCM	202.4	353

Use 1.74A/mm^2 for other cable sizes.

5.5.2 Terminal Preparation

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

5.5.3 Connector Installation

The VALEN GEL batteries are supplied with hardware to attach the cables. Install the cables (positive of one battery to negative of the next) and the hardware. Hand tighten only at this time to allow room for positioning of the blocs. Once all cables are in place, all connections should be torqued to the values below:
12 VG 21-33 5.1Nm (45 in pound)
12 VG 40-100 7.4Nm (65 in pound)
12 VG 120-240 10.2Nm (90 in pound)

DO NOT OVER TORQUE!

CAUTION! Use extreme care not to short the battery connections. VALEN GEL Batteries are capable of very high short circuit currents containing a very high energy level. Install the inter-tier cabling at the time, following the same general instructions as for installing the interbloc connections. Attach the inter-tier cabling to the wall or the rack so that the weight of the cable is not on the battery terminal. If using a stiff cable, pre-bend the cable so no 'spring' force is placed on the battery terminals. Failure to support the cable weight could result in a premature battery failure and loss of battery integrity.

5.5.4 Voltage Checks

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

CAUTION! High voltage present. The total string voltage should be approx. 12.5V or 6.25V for 6V batteries, multiplied by the no. of blocs in the string. If the measured string voltage is not close to the calculated value, recheck the battery connections to ensure proper polarity sequences and measure the individual bloc voltages. Calculate the average bloc voltage and use this value to refigure the string voltage. If the recalculated and measured string voltages do not match reasonably well, contact VALEN for further instructions.

5.5.5 Battery-Charger Connection

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

5.5.6 Paralleling of Batteries

When greater battery capacity is desired than what is available from a single cell or string, paralleling of batteries becomes necessary. Batteries must be properly paralleled in order to get the best system performance and longest battery life. The battery strings must be treated as equally as possible. This means equal length cabling to a common collection point for the load cables, uniform temperature between the strings and equal strings of batteries. Do not parallel flooded batteries with valve-regulated batteries as the charge voltages differ between the types of batteries. To check the proper paralleling of the strings, connect the strings in the final form and place a load on the battery. Measure the load cable voltage drops. The voltage drops should match within 10%.

SECTION 6 OPERATION

6.1 Initial Charge

VALEN recommends that VALEN GEL Batteries be given an initial charge/equalisation charge at the time of installation in order to ensure that the batteries are fully charged and the bloc voltages are uniform. If an initial charge is not given at the time of installation then bloc float voltages may take some months to become uniform. The initial or equalise charge for the VALEN GEL Batteries is 2.35VPC at 20°C. Calculate the initial charge voltage for your installation based on either the no. of cells in the string or the no. of blocs in the string. Turn on the charger and raise the charger output voltage (using the equalisation control) to the calculated value. Leave the string charging at this level for 24 hours. At the end of this time, reduce the charger output voltage to the float voltage level. See section 6.2. Just prior to the reducing the string voltage to the float voltage, measure the bloc voltages and charge current is possible. If the charger output cannot be raised to the calculated initial charge voltage or the load cannot tolerate a charge voltage this high, raise the charger output voltage to the max. permissible level. Measure the charger output voltage per cell. Use the following as a guideline:

Max. Voltage obtained (20°C)	Charge time (hrs) min./max.
2.33-2.35VPC	12/24
2.31-2.33VPC	36/48

At voltages below 2.29VPC adequate equalisation will not be obtained. Contact VALEN for additional details on procedures to equalise a battery under these conditions. If the ambient temperature is not 20°C, the initial charge voltage will have to be temperature compensated (TC). TC is the process whereby the charge

voltage is changed as the function of the battery temperature. The temperature correction factor (TCF) for VALEN GEL Batteries is -0.003V/Cell/°C from a 20°C baseline temperature. As the battery temperature rises (falls) above (beneath) 20°C, the charge voltage must be reduced (raised) the TCF amount for every degree of change. The formula to calculate the temperature corrected voltage is: TCV = CV (20°C) ± [T-20°C] x (-0.003VPC). As an example, if the initial charge was going to perform at 32°C, the temperature corrected, reduced charge voltage would be:
TCV = 2.35 – (32-20) x (-0.003VPC) = 2.31VPC

6.2 Float Voltage

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

6.2.1 Float Voltage Requirements

The recommended float voltage for the VALEN GEL Batteries is 2.25VPC at 20°C ± 1°C.

6.2.2 Float Temperature Compensation

The float voltage temperature compensation factor is 0.005V/Cell/°C from a 20°C baseline (the same as the equalisation TCF). For other temperatures use the following table:

Temp °C		Float Voltage VPC
10	BASELINE	2.290
15		2.270
20		2.250
25		2.250
30		2.230
35		2.210

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

6.3 Maximum Charge Current

The charge current is normally limited by using the recommended float voltage. At higher charge voltages the max. charge current should be limited to prevent the possibility of charging the batteries at a higher rate than they can efficiently accept. Greater than recommended max. charge currents can result in excessive battery heating and gassing and a shortened battery life. Max. charge rates for VALEN GEL Batteries are:

Type	Amps
6 VG 225	31.0
12 VG 21	4.02
12 VG 33	4.80
12 VG 40	6.50
12 VG 55	8.51
12 VG 70	10.8
12 VG 100	15.5

6.4 Recharge

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

Ah discharged	x F = charge time hr.
Avail. Charge Current	

Where F = 3 if the batteries are charged at the float voltage and F = 2 if an equalisation voltage is needed. Do not exceed the max. charge currents listed in section 6.3.

6.5 Equalisation Charge

The equalisation charge voltage of the VALEN GEL Battery is 2.35VPC at 20°C. While equalisation is not required under normal operating conditions, it is possible to operate the battery in such a way that equalisation would be needed. These conditions would include:

- Temperature variation in the string greater than 3°C
- Low float voltage
- Low operational temperature without temperature compensation
- Frequent deep discharges
- Rapid recharge required
- Long delay in recharging the battery after a discharge
- Unevenly paralleled string balance

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

SECTION 7 STORAGE

When installed, VALEN GEL Batteries will not be used (floated) for a period of time, the following procedure should be followed:

1. Equalise charge the battery (refer to section 6.5).
2. Disconnect the battery from all loads. Do not allow any loads, no matter how small, to remain connected.
3. Equalise charge the battery every 6 months when the storage temperature is 20°C or less. For every 8°C rise in storage temperature, reduce the storage/equalisation interval by half.

Perform an equalisation charge on the battery prior to returning to service. During the storage time, particularly if it is extended, it is recommended to continue to monitor and record battery voltage levels. Measure and record the battery open circuit voltage just before equalisation and then record the on-charge voltage and current prior to completing the charge. Refer to section 4 for more information.

SECTION 8 - MAINTENANCE & RECORDS

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

8.1 General Maintenance

General maintenance of the battery means keeping the battery and surrounding area clean and dry. Since VALEN GEL Batteries are of low maintenance design, there is no addition of water or specific gravity checks needed for the life of the battery. The only required maintenance action is an annual retorque of the battery connections; see table 1 in section 5.5.1 for retorque values. Review section 2.4 on electrical shock before performing this action.

CAUTION! Use only insulated tools. Do not use any solvents or strong cleaners on or around the batteries. A dry brush may be used to remove any dust accumulations. If required a solution of 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.

8.2 General Records

8.2.1 Installation Records

When the battery is first received record:

- Date of receipt
- Condition of the battery blocs
- Open circuit voltage of each bloc
- Date of installation
- Original PO number
- Installer(s)
- Equalisation time and voltage
- Any unusual storage conditions
- Individual bloc voltages
- Ambient temperature

- Float current
- Battery temperature
- String float voltage

8.2.2 Maintenance Records

Twice per year, record the following:

- Bloc float voltages
- String voltage
- Float current
- Ambient temperature
- Battery temperature
- Battery conditions
- Any unusual charges or discharges – 6 months

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

VALEN GEL BATTERY REPORT

Installed By:		Representative	
Operating Company		Date:	Time:
Battery Information			
Type of Battery:		№ of Cells/String:	String Float Voltage:
Installation Date:		№ of Strings/Battery:	
Battery Charge Current:		Battery Code:	Float Current:
Charging Equipment:		Ambient Temp.:	Bloc Temp.:
Battery Charger Information			
Make:		Type:	Current Rating:
Model:		Year of Mfg.	Charging Voltage

INDIVIDUAL CELL READINGS

Cell №	Cell ID	Float Volts	Cell №	Cell ID	Float Volts	Cell №	Cell ID	Float Volts	Cell №	Cell ID	Float Volts	Cell №	Cell ID	Float Volts
1			26			51			76			101		
2			27			52			77			102		
3			28			53			78			103		
4			29			54			79			104		
5			30			55			80			105		
6			31			56			81			106		
7			32			57			82			107		
8			33			58			83			108		
9			34			59			84			109		
10			35			60			85			110		
11			36			61			86			111		
12			37			62			87			112		
13			38			63			88			113		
14			39			64			89			114		
15			40			65			90			115		
16			41			66			91			116		
17			42			67			92			117		
18			43			68			93			118		
19			44			69			94			119		
20			45			70			95			120		
21			46			71			96			121		
22			47			72			97			122		
23			48			73			98			123		
24			49			74			99			124		
25			50			75			100			125		

Remarks and Recommendations:
Signed:

VALEN GEL BATTERY MAINTENANCE REGISTER	
Date	Maintenance Description

VALEN Power | Powering Potential

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