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Installation and Operating Instructions for
Monolite
Valve-Regulated Lead Acid Batteries

Monolite

FIAMM

Important Note
Monolite batteries must be placed on charge within 6 months from date of shipment. Failure to observe this requirement could result in permanent damage! (See section 5 for details)

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1. INTRODUCTION

Monolite batteries belong to the category of valve-regulated lead acid (VRLA) batteries, also sometimes known as ‘recombination’ or, incorrectly, as ‘sealed’ batteries.

The Monolite range is manufactured as single cells or multi-cell modules, depending on the rated capacity. The initial digit(s) of the part number indicate the nominal voltage of each module, while the final digits indicate the rated capacity. To determine the number of cells in a module, divide the nominal voltage by 2. For example, the 12SLA25 has a nominal voltage of 12 V and comprises 6 cells of 25 ampere hours, while the 2SLA300 is a 2 volt, single cell unit rated at 300 Ah. Throughout this manual, both single-cell and multi-cell types will be referred to as ‘modules’; voltages will be given on a per-cell basis and should be multiplied by the number of cells per module to obtain the applicable values for each module.

2. SAFETY

Under normal operating conditions, Monolite batteries vent very little gas and emit no acid fumes. They are therefore safer than ‘vented’ or ‘wet’ battery types, and in fact are normally considered to be ‘office compatible’. However. under abusive conditions, such as a charger malfunction or physical damage, the potential exists for explosive gas mixtures to be produced, or for corrosive acid fumes or leaks to be present. For this reason, it is recommended that full precautions be taken at all times when working on Monolite batteries.

2.1 Protective Equipment

Make sure that the following equipment is available to personnel working with batteries:

- Goggles and face shields
- Acid resistant gloves
- Protective aprons
- Eyewash/shower facilities for flushing eyes or skin in case of acid spillage
- Class C fire extinguisher
- Tools with insulated handles

2.2 Safety Precautions

Observe the following precautions at all times. Batteries are no more dangerous than any other equipment when handled correctly:

- Acid is corrosive - wear protective clothing, rubber gloves and goggles when handling batteries and electrolyte
- Do not allow metal objects to rest on the battery or fall across the terminals. Never wear rings or metal wrist bands when working on batteries
- Do not smoke or permit open flames near batteries or do anything to cause sparks
- Avoid contact with acid on the skin or clothing. If acid contacts the skin, flush immediately with large amounts of clean water, then cover with dry gauze. If acid comes into contact with the eyes, flush immediately with clean water for at least 15 minutes. In all cases, obtain immediate medical attention.

3. OPERATING PRINCIPLES

During the charging of conventional lead acid batteries, water is lost due to electrolysis, resulting in the venting of explosive mixtures of hydrogen and oxygen, and the need for periodic water additions. High-rate charging can also result in the venting of droplets of sulfuric acid, leading to potential corrosion problems.

Monolite cells are valve-regulated, meaning that they provide a means for recombining charge gas and a valve for regulating internal pressure, thus optimizing recombination efficiency. The acid is absorbed into a glass fiber mat separator, which allows charge gas to pass easily from the positive to the negative plate, where the recombination reaction occurs.

By virtually eliminating electrolysis, there is no longer any need for water additions, thus making these batteries "maintenance-free", at least with respect to the electrolyte. The extremely low level of gas vented from Monolite batteries, combined with the lack of acid fumes, makes them suitable for installation in office environments, provided that adequate precautions are taken regarding ventilation and personnel access. Laboratory test measurements at 25°C (77°F) show the following gassing rates:

- 2 ml/Ah/cell/month at a float voltage of 2.27 V/cell
- 10 ml/Ah/cell/month at a recharge voltage of 2.40 V/cell

Because it is not possible to add water to the Monolite cells, it is important to maintain a closely-controlled charging regime at all times in order to obtain the longest possible battery life. By carefully following the instructions in this booklet, you will be able to obtain the longest life and most reliable service from your Monolite battery.

4. UNPACKING

4.1 Inspection

Upon receiving a shipment, inspect each of the packing cases for possible transit damage. Open the shipping containers and carefully check the modules and hardware against the packing list.

The contents of each consignment are carefully inspected before shipment. Any damage must be reported immediately to the carrier and the damaged items retained for inspection by the carrier's representative.

4.2 Handling

Monolite modules are shipped fully charged and must be treated with care at all times. The product is capable of supplying high short circuit currents, even if the case or lid are damaged. Always lift the individual modules from underneath, or by the built-in lifting handles. Never apply force to or drop anything on the terminal posts, doing so may damage the threads or the post seals.

5. STORAGE

If the battery cannot be immediately installed, it should be stored in a clean, cool, dry area. Storage temperatures should not exceed 32°C (90°F) if possible, otherwise more frequent freshening charges will be necessary. Freshening charges should be given at least every 6 months, or when the module voltage drops below 2.11 V/cell. A freshening charge is carried out by charging at 2.27 V/cell for approximately 48 hours.

6. INSTALLATION

6.1 Room Requirements

The battery should be installed in a clean, cool, dry room. Care must be taken in providing adequate floor loading capability and sufficient aisle space for servicing. Good lighting is also important for carrying out visual inspections. Access to the battery should be restricted to qualified personnel only.

6.1.1 Racks

Battery racks should be installed as level as possible and mounted securely to the floor as applicable. The depth and height of the rack, along with servicing headroom, must allow for adequate ventilation and satisfactory servicing.

6.1.2 Cabinets

Good ventilation is extremely important for battery cabinets. Ventilation openings should be at the base of the cabinet, and as close as possible to the top, to prevent any buildup of hydrogen gas in an abusive situation. As with battery racks, cabinets should be level and anchored firmly to the floor as required. All modules should be accessible for visual inspections and voltage checks.

6.2 Temperature

Battery life and performance are optimal at a temperature of 20-25°C (68-77°F). Operation at lower temperatures will reduce available capacity, while higher operating temperatures will shorten battery life.

Air circulation within the battery room must be sufficient to avoid hot or cold spots. The total temperature spread (hottest cell to coldest cell) should not exceed 3°C (5°F).

6.3 Ventilation

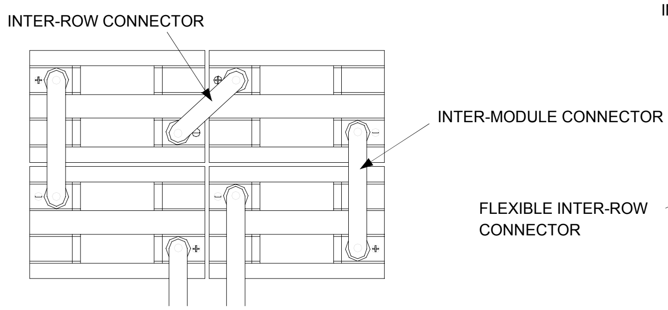
Under normal conditions, the gassing rate of Monolite batteries is extremely low, and no acid fumes are given off. However, the battery room should have sufficient natural ventilation to avoid temperature rises and to protect for the possibility of an over-charge condition, for example, in the event of a charger malfunction.

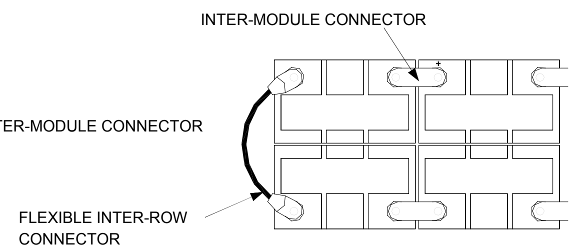
The recombination reaction generates heat, and it is important that this heat be allowed to dissipate easily. Ventilation must be adequate to allow the battery to reach thermal equilibrium at a temperature no higher than 3°C (5°F) above ambient.

6.4 Connections

Clean the modules with a soft dry cloth or soft water-moistened cloth, then arrange the modules in the intended location. For racks and cabinets, start from the lowest level in the center and work out sideways and then upward from there. Make sure that the modules are arranged to preserve the normal series connection sequence (negative of module #1 to positive of module #2, negative of #2 to positive of #3, etc.) throughout the battery. Leave a small space between each module for ventilation - the exact space is determined by the solid connector strap used. The following diagrams show the normal layout for each module type.

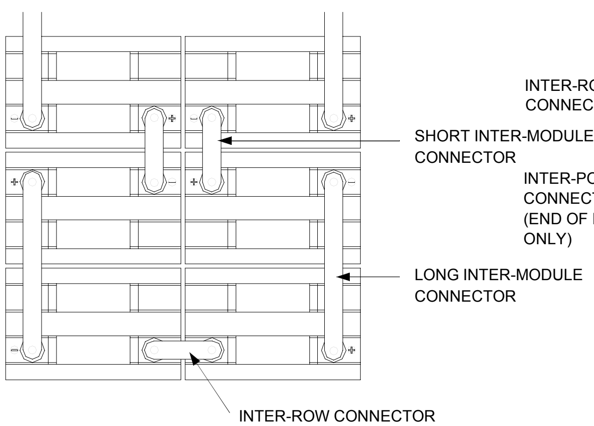
6SLA100
2SLA200
2SLA250
2SLA300

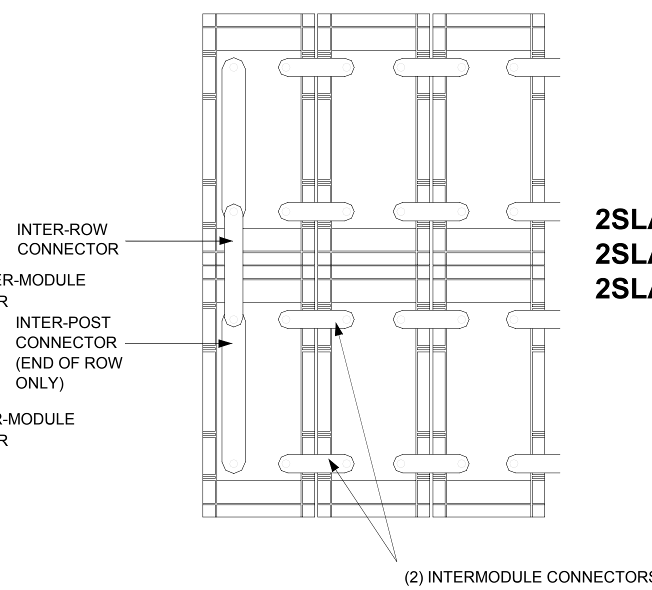




12SLA25
12SLA30

12SLA37
12SLA50
4SLA150





2SLA400
2SLA500
2SLA580

MONOLITE INTER-MODULE CONNECTORS

Clean the flat contact-making surfaces of the terminal posts and connectors with a soft clean cloth. Lightly abrade these surfaces with a Scotchbrite pad or fine grit abrasive paper, to remove any surface oxidation. **Do not** use a wire brush and be especially careful not to break through the lead plating. Apply a light coating of 'No-Ox-Id' grease to the contact-making surfaces and place a solid connector strap in position. Lightly smear 'No-Ox-Id' grease on the washer and nut and tighten the parts firmly together using the insulated wrench supplied. The correct torque setting for the terminal nut is 7.5-8.0 Nm (65-70 in.lb.) for modules up to a 2SLA300, and 9.5-10.0 Nm (85-90 in.lb.) for the 2SLA400-2SLA1000 range.

After all the solid connections have been fastened in place, complete the battery connections by attaching the inter-row, inter-tier, or inter-rack flexible connectors. Make a final check of the polarity of the connections. The best way to do this is to measure the overall battery voltage and to make sure that this value is equal to the open circuit voltage of an individual module multiplied by the number of modules.

Finally, connect the main positive terminal of the battery to the positive terminal of the charger and the battery negative to the charger negative.

Monolite batteries are provided with snap-on connector covers. These should be installed after it is certain all connections have been properly made.

Affix the number labels to each module, making sure that the surfaces are dry and clean. It is usual to number the modules beginning with #1 at the positive end of the battery, numbering consecutively in the same order as the modules are connected electrically, through to the negative end of the battery.

7. CHARGING

7.1 Float Operation

Use only constant voltage chargers with Monolite batteries. The recommended float voltage is 2.27 V/cell at 25°C (77°F). This is also the voltage recommended for freshening charges during extended storage periods (see section 5).

When using a float voltage of 2.27 V/cell, it is not usually necessary to limit the charger output. If higher charge voltages are used on recharge, the charge current should be limited to 25% of the battery capacity.

The normal float current observed in fully charged Monolite batteries at 2.27 V/cell and 25°C (77°F) is approximately 0.3mA/Ah. Although the charger is set to an average voltage of 2.27 V/cell, it is normal to see a spread of module voltages. Variations of ±30 mV/cell or more are acceptable, particularly during the first year of operation.

7.2 Equalize Charging

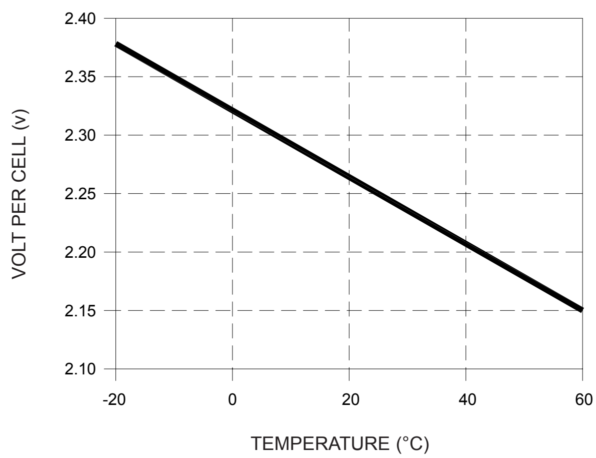
Equalize or high rate charging should be used only when necessary. Frequent equalizing can result in water consumption, which will lead to reduced capacity and shortened battery life. If necessary for fast recharge, equalizing may be carried out at voltages up to

2.40 V/cell. The battery should be placed back on float as soon as possible, ideally as soon as the charge current has dropped below 30 mA/Ah.

It may also be necessary to equalize a battery if individual modules are showing a float voltage of less than 2.20 V/cell. In these cases, the equalize time should not exceed 24 hours. It is also possible to equalize individual modules showing low float voltages, although this will require special charging equipment.

7.3 Temperature Compensation

To optimize battery life and performance over the normal operating temperature range of -15 to +40°C (+5° to +104°F), the float voltage should be adjusted in accordance with the graph shown below.



Temperature Compensation Curve

If long term temperature fluctuations are expected, it is permissible to adjust the charge voltage manually as necessary; however, in most environments which are not climate controlled, temperature variations occur in relatively short periods and is much more practical to use a charger with a built-in temperature compensation circuit. The sensing for such a circuit should be on the surface of a module (not in the charger). The above curve is based on 20°C, above 20°C the slope is -2.5 mV/°C, below 20°C +2.5 mV/°C

7.4 Ripple

Some applications, most notably on-line uninterruptible power systems, have a large connected load which must be supplied by the battery charger at all times. It is not unusual for such systems to have a rated charger output which is larger than the battery rated capacity. Whenever the chsrger output current is larger than 25% of the battery rated capacity, it is important to monitor the degree of a.c. ripple current to which the battery is subjected, particularly since charger capacitors tend to degrade over time. Excessive ripple currents can cause battery overheating and will reduce life and performance.

These effects can be avoided by using the correct charger; it must feature voltage regulation, with the battery disconnected, of ±1% from no load to full load under all operating conditions; and under full load with the battery disconnected, the peak-to-peak voltage must fall within ±2.5% of the recommended float voltage of 2.27 V/cell. Furthermore, under normal float conditions the current flowing through the battery must never reverse into the discharge mode.

To minimize ripple where high-output chargers are used, it is advisable to incorporate the charger manufacturer's filtering option. Typically, two levels of filtering are offered. The standard level of filtering for telecommunications chargers, and a 'battery eliminator' option, which features a higher level of filtering. The most suitable option will depend on the relationship between the charger output and the battery capacity, and the normal level of filtering incorporated by the charger manufacturer. Contact the factory for additional information regarding charger filtering.

7.5 Determining State of Charge

It is possible to determine when the battery reaches a high state of charge by observing the behavior of the battery or charger during a recharge.

If the connected load being supplied by the charger is constant, the charger output during a recharge will gradually taper off as the battery approaches a fully charged state. When the charge current has remained stable for at least two hours, then the battery is at least 90-95% charged.

In cases where the connected load is variable and there is no way to measure the charge current into the battery, similar information may be obtained by observing the battery voltage. Towards the end of recharge, when the battery voltage has remained stable for at least three hours, the battery should be at least 90% charged. This method is less precise than examining the charge current.

If the battery has been standing on open circuit for at least 24 hours, it is possible to assess the state of charge from the module voltage. The following table shows the relationship between open circuit voltage and state of charge.

Open Circuit Voltage (V/cell)	State of Charge (% of full charge capacity)
2.14 - 2.15	100
2.12 - 2.13	90
2.11	80
2.09	70
2.07	60
2.05	50

8. MAINTENANCE AND TESTING

Despite claims by some manufacturers that batteries similar to the Monolite are 'maintenance-free', **this is a misnomer.** VRLA batteries are maintenance-free with respect to electrolyte, but it is important to observe other maintenance procedures to assure the longevity and reliability of the battery.

8.1 Schedule

The user must determine what constitutes an appropriate maintenance schedule. The following factors should be considered:

- Criticality of the connected load (or acceptability of battery failure)
- Battery replacement procedures
- Operating environment

If the connected load is extremely critical and a battery failure is considered to be unacceptable, then a stringent maintenance schedule will be required, with frequent checks of charge voltage and battery capacity, among others. On the other hand, if a battery failure would be merely inconvenient, then a more relaxed maintenance schedule would be appropriate.

Regular capacity tests are necessary if the user wishes to trend the battery's aging, and institute replacement when the battery is nearing its useful life. An equally acceptable alternative might be to replace the battery, say at 80% of the normal life expectancy for a particular application, regardless of the actual capacity at that time; in this way, the expense of periodic capacity testing could be avoided.

As with any other VRLA type, a Monolite battery will operate more reliably in a benign environment than in a harsh one. For example, a battery in an air-conditioned room, which is subject to infrequent discharges, can be assigned a less stringent maintenance routine than a frequently-cycled battery in an uncontrolled climate.

Lastly, it may be possible to substitute certain maintenance procedures for others. For example, there is a body of evidence to show that impedance or conductance measurements are more informative than individual module voltage checks. In addition, these measurements may prove to be an effective substitute for regular capacity tests (see section 8.6 for additional information).

The following sections detail each of the maintenance and test procedures that may be employed, and indicates the recommended frequency of each operation as it relates to both critical and non-critical applications.

8.2 Pilot Module

For regular monitoring of the battery condition, select one module as a 'pilot' module. The module selected should be the one with the lowest float voltage, and may change from time to time. The pilot module voltage and temperature should be measured whenever overall battery readings are taken. This will serve as an additional indicator of battery condition at those times when a full set of module readings is not scheduled.

8.3 Visual Inspections

Monolite batteries should be inspected visually on a monthly basis for critical applications, or quarterly for non-critical installations. Check for the following:

- Cleanliness of the battery and surrounding area
- Signs of corrosion at the terminals, connections, or support structure (rack or cabinet)
- Module integrity: check for cracks, or excessive jar/cover distortion, or signs of electrolyte leaks or seepage

If any physical damage is apparent, it is likely that the module concerned will have to be replaced. This can often be confirmed by checking the module float voltage and/or temperature. Contact the factory for additional information.

8.4 Cleaning

Clean the modules when necessary, using a soft dry cloth or water-moistened soft cloth. Take care not to cause any ground faults when cleaning the battery.

CAUTION
Do not use detergents, solvent-based cleaning agents, or abrasive cleaners. Use of these materials could result in permanent damage to the modules.

8.5 Voltage Checks

All voltage measurements should be made when the battery has stabilized on float, at least 3 days after a battery discharge or equalize charge.

8.5.1 Overall Float Voltage

Maintenance of the correct battery charge voltage is extremely important for the reliability and life of the battery. Check that the overall stabilized float voltage is set to 2.27 V/cell (±1%) every month in critical applications, or every quarter in non-critical uses.

8.5.2 Individual Module Voltages

Measure and record individual module voltages on float at least every year. In critical applications it is prudent to increase this frequency to quarterly, unless routine impedance/conductance measurements are being taken (see section 8.6).

It is normal to see a spread of module voltages of up to ±30 mV/cell, particularly in the first year of operation. No corrective action is required in this case. If any module voltage is below 2.20 V/cell, and this is not as a result of temperature variations within the battery string, an equalize charge should be given to either the whole string or the individual module (see section 7.2).

8.6 Temperature Measurements

Whenever individual module voltages are measured, it is advisable to measure module temperatures also. The total spread of module temperatures should not exceed 3°C (5°F), nor should the average battery temperature be more than 3°C (5°F) above ambient. If either of these situations exist, take corrective action or contact the factory for assistance.

The best position for measuring the temperature of an individual module is at the negative terminal post or on the module side wall.

8.7 Impedance/Conductance Measurements

The impedance or conductance of a module is measured by passing an a.c. current through either a single module or the entire battery, then measuring the appropriate parameter at the module terminals. A variety of equipment, ranging from fixed to portable to hand-held, is available, and it is not in our expertise to make representations as to the suitability of any particular piece of equipment for its intended purpose.

Although this class of measurement is relatively new in battery applications, there is a growing body of evidence to support at least some of the claims being made by the manufacturers of this equipment. By measuring the internal current path of a module, including the plate grids and the electrolyte, the main failure modes of VRLA batteries, grid corrosion and dry out, are being monitored.

If these readings are made over the life of a battery, comparison to baseline readings can give a measure of the battery's aging. If baseline data is not available, impedance or conductance measurements can still show when an individual module is about to fail. From this standpoint, these readings can be more valuable than module voltage measurements in highlighting potential problems, and may provide a substitute for capacity testing in some applications. To be sure, voltage readings are still important in determining correct charging of a battery, and discharge testing remains the only absolute indication of battery capacity, but impedance/conductance measurements can be an extremely important addition to the data gathered during battery maintenance.

It is not necessary that your impedance readings match those published on page 12. The internal resistance values given refer to a conventional internal resistance measured according to the International Standard IEC 60896-1/-2. It is a conventional DC resistance calculated from the initial values of voltage at two different discharge currents (I1,V1) (I2,V2) and then extrapolating the value of current at V=0 (i.e. short circuit). So you get the conventional short circuit Icc. The internal resistance is then calculated Rint = 2 Volt / Icc.

The instrument manufacturers use several different techniques to measure ohmic values:

1.DC resistance is measured by applying a momentary load across the module and measuring the resulting step change in voltage and current. By dividing the change in voltage by the change in current, DC resistance can be calculated using Ohms Law and results are expressed in micro-ohms.

2. Impedance testing is done by passing an AC current at a specific frequency and amplitude through the battery and then measuring the AC voltage drop between the positive and negative battery terminals. Here again the results are calculated using Ohms Law and the results are expressed in micro-ohms.

3. Conductance measurements are performed by applying an AC voltage of a known frequency and amplitude across the module and observing the current compared to the amplitude of the AC voltage producing the current. The results are expressed in Siemens or Mhos.

Due to the variations of these different techniques, it is recommended to establish a baseline with your test equipment for the trending, and continue to use the same equipment for each consecutive measurement through out the life of the battery.

In critical applications, impedance/conductance should be measured on a quarterly basis. As the criticality of the application is reduced and the consequences of battery failure become more tolerable, the readings may be taken with reduced frequency, or may be eliminated completely.

Module Type	Capacity)Ah)	Impedance (milliohms)
12SLA25	25	11
12SLA30	30	9
12SLA37	37	8
12SLA50	50	6
12SLA75	75	4
6SLA100	100	1.7
6SLA125	125	1.4
4SLA150	150	0.7
2SLA200	200	0.4
2SLA250	250	0.35
2SLA300	300	0.32
2SLA400*	400	0.22
2SLA500*	500	0.21
2SLA580*	580	0.19
2SLA800*	800	0.206
2SLA1000*	1000	0.165

* Denotes modules fitted with 4 terminal posts

A general rule of thumb is that a module should be closely monitored if its impedance increases by more than 30%, either from the baseline or above the average of the remainder of the modules. A 50% increase would justify a discharge test as soon as possible to determine whether the module may remain in service. The corresponding figures for conductance measurements are a reduction to 80% of the original baseline (or of the remainder of the cells) and 70% of the baseline, respectively.

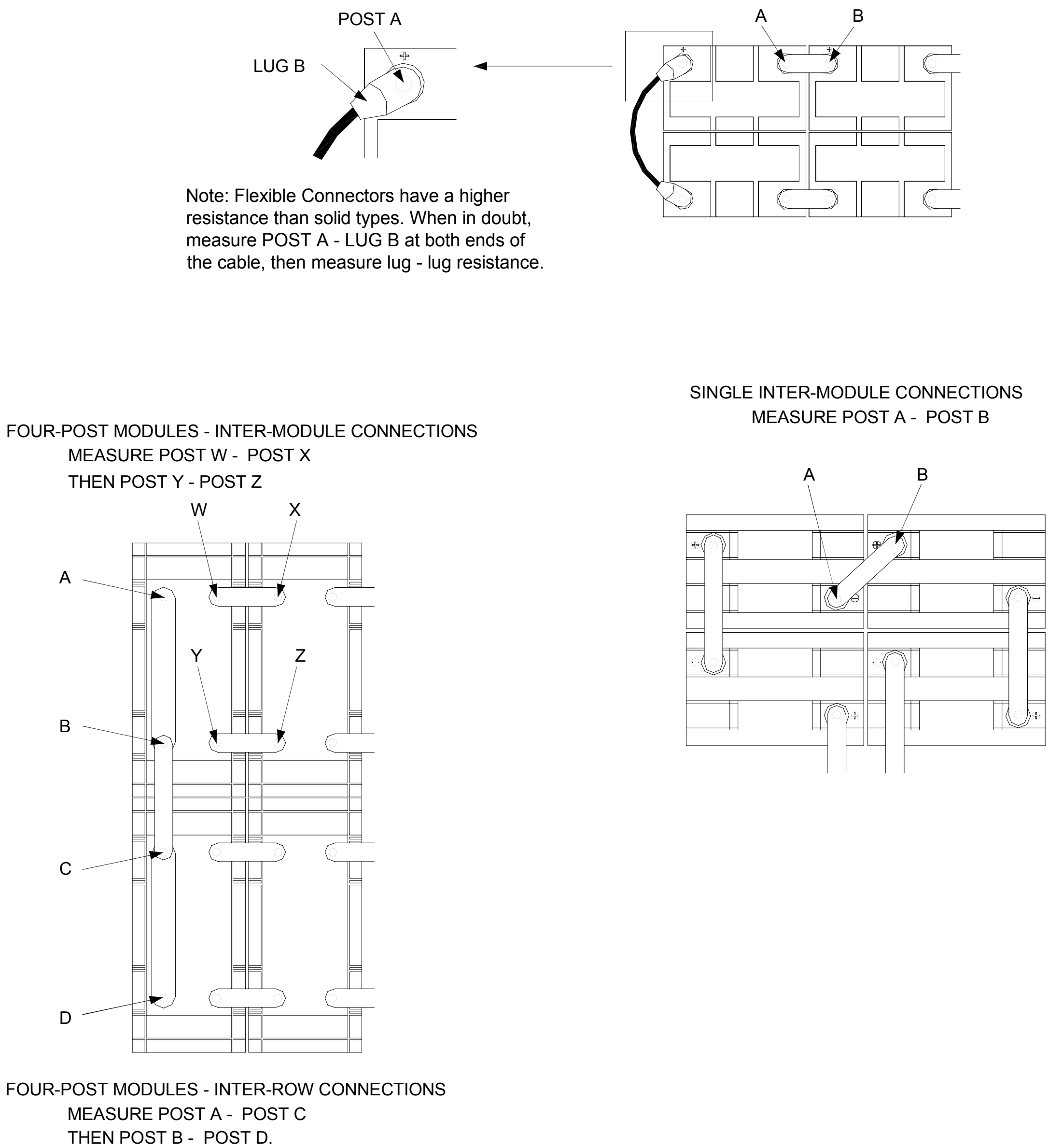
8.8 Connection Resistance

In less critical applications, or those involving low discharge currents, it is generally acceptable to ensure the integrity of the inter-module connections by retorquing the connector hardware on an annual basis, or by checking for signs of connector heating during a discharge.

Using a digital microohmmeter, it is possible to measure the resistance of an individual battery connection with precision. Such measurements can be of importance in applications involving high discharge currents, since high-resistance connections can cause excessive voltage drops and a reduction in available capacity from the battery.

The diagrams on the following page show the points where connection resistances should be measured.

In critical applications involving high discharge rates, connection resistances should be measured on a yearly basis. The normal practice is to obtain baseline readings at the time of installation, and to take corrective action if any resistance is found to exceed its baseline value, or the average of the rest of the battery, by more than 20%. Corrective action normally involves retorquing the post nut, but could also require that the connection be disassembled, cleaned, and reassembled.



CONNECTION RESISTANCE MEASUREMENT

8.9 Charger Ripple

In those applications where the charger rated output current is considerably above the normal maximum of 25% of the battery capacity (typically in UPS duties), there is a possibility that the battery could be subjected to unacceptable high levels of a.c. ripple (see section 7.4). In critical applications, the peak-to-peak ripple voltage should be measured yearly to ensure that it does not exceed ±2.5% of the recommended 2.27 V/cell float voltage, with the battery disconnected. In less critical applications, or those in which the charger output is relatively low, it is acceptable to measure the module temperatures on an annual basis, to ensure that the average operating temperature is not more than 3°C (5°F) above ambient (see section 8.5).

8.10 Discharge Testing

8.10.1 Schedule

Since discharge or load testing gives the only absolute measure of battery capacity, it is of great importance in critical applications. In such duties, it is recommended that capacity tests be carried out on a yearly basis until the battery shows signs of degradation, and every six months thereafter. Although this is more frequent than the testing recommended for vented lead acid batteries, it reflects the more complex nature of the VRLA system, and the fact that certain maintenance practices (internal visual inspections, specific gravity checks) are precluded in these batteries.

8.10.2 Test Methods

In addition to this operating manual it is also recommended to purchase a copy of the IEEE 1188-1996 or newer revision 'Recommended Practice for Maintenance, Testing,, and Replacement of Valve-Regulated Lead-Acid (VRLA) Batteries for Stationary Applications'.

(see the next page under additional information)

The operating temperature of the battery will affect the available capacity. For discharge tests that are carried out at temperatures other than 25°C (77°F), the following temperature correction factors should be used:

Temperature		Correction Factor
°C	°F	
-30	-22	2.00
-15	5	1.37
-10	14	1.32
-5	23	1.23
0	32	1.16
5	41	1.14
10	50	1.10
15	59	1.06
20	68	1.01
25	77	1.00
30	86	0.97
35	95	0.95
40	104	0.93

To obtain a temperature-corrected discharge rate, the published performance figure for the chosen discharge time and end-of-discharge voltage should be divided by the appropriate correction factor from the above table.

9. RECORDS

Complex written records of all maintenance and testing operations are important in ensuring the reliability and longevity of Monolite batteries. Adequate records which are properly reviewed will frequently indicate when corrective action should be taken, even if an individual set of readings shows nothing out of the ordinary.

The sample form at the end of this booklet can be used for record-keeping purposes.

10. ADDITIONAL INFORMATION

Some important points to keep in mind especially when you are hiring a contractor to do your installation, maintenance and especially important when hiring a contractor to do a capacity test on your battery.

It is wise to stipulate in your purchase order to a contractor, that all of the recommendations in this operating manual, IEEE, and your requirements must be met or the work must be re-done at their expense, especially reference an improper capacity test.

Proper operation of your battery starts with the initial installation. Ensure that the installer provides you with initial records stating the date the battery was commissioned, and includes the supporting data that they have followed the recommendations as outlined in this operating manual. Refreshening/Commissioning charge is an important start-up step that is often missed during the installation process.

Ensue that the contractor has the proper test equipment to perform your test, and that it has been calibrated. The ideal equipment for a capacity test is a constant current load bank capable of holding the discharge current constant throughout the test, and a data logger to record the individual cell voltages and warn of cells reaching a critical voltage

A load bank that is not constant current requires the contractor to continually readjust the current manually during the test, sometimes the readjustment is forgotten and the test is invalid.

If a datalogger is not used to capture the individual cell voltages at a precise time, the tester must manually read and record the values. If you have only 24 cells or less, a reasonably accurate test may be done manually, but on more than 24 cells the manual method becomes in-accurate. On a 60-cell battery it may take 10 minutes or more to manually read and record all of the individual cell voltages. Example: If you are doing a one hour test on 60 cells, and you start to record the voltages at 48 minutes, by the time you reach cell number 60, the time is 58 minutes. This relates to a range of capacity from 80% to 96.6%, which is the difference from a good battery to a battery that is ready to be replaced.

It is important to record all of the individual cell voltages on float, meaning with the charger on prior to a test. This is very important in reviewing test results, and is often missing from test data submitted for review.

If the initial float voltages are outside the factory recommendations; is it worth the cost of having a capacity test done at this time?

It would be more cost effective to take corrective action prior to paying the cost for a full capacity test, which would need to be repeated after implementing the corrective actions.

Monolite Battery Maintenance Report

Battery Location		Report Dates: From	
Module Type		To	
No. of Modules		Charger Mfg.	
Date Installed		Charger Model	

Pilot Module #	

Battery/Pilot Module Readings

Date	Visual Inspection*			Charging		Pilot Module		Ambient Temp.
	Battery Clean?	Free From Corrosion?	Physically Sound?	Terminal Voltage	Charge Current	Voltage	Temp.	

* Answer Y/N. Provide comments below for any 'N' response. See manual section 8.3 for details.

Comments (Provide Date)

____

____

____

____

____

____

Corrective Action (Provide Date)

____

____

____

____

____

____

Prepared By: ______________________ Date ______________________

Monolite Battery Maintenance Report

Individual Module Readings

Module #	Float Voltage	Module Temperature	Impedance/ Conductance	Connection Resistance
1				
2				
3				
4				
5				
6				
7				
8				
9				
0				
1				
2				
3				
4				
5				
6				
7				
8				
9				
0				
1				
2				
3				
4				
5				
6				
7				
8				
9				
0				

Module #	Float Voltage	Module Temperature	Impedance/ Conductance	Connection Resistance
1				
2				
3				
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8				
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0				

NORMAL INDICATIONS:

Module voltage - battery average + or -0.03 V.   Module temperature < (ambient temp. + 3°C (5°F))

Represented in your area by:

Doc. No. 3202-2-1002

Delivering quality

ALCAD

Alcad Standby Batteries
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North Haven, CT 06473

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