Shoto 6-FMX Series

Front Terminal Blocks

Installation, Operation and Maintenance Guide

Issue 1.00 Dec 2017

! IMPORTANT NOTICE

Please read this manual immediately on receipt of the battery, before unpacking and installation. Failure to comply with these instructions can render warranties null and void.

Care for your safety

Read these instructions before preparing to install the batteries. The instructions contain information that will assist you in your task, provide information about what is contained in the packaging, and information about the battery performance and characteristics.

Do not smoke near the batteries.

Avoid naked flames near from the batteries.

Avoid electrical or static sparks near the battery, particularly when the battery is under charge at elevated voltages.

Batteries are delivered in a fully charged state and must be carefully unpacked and handled to avoid very high short circuit currents between terminals of opposite polarity.

When connecting the blocks in series, high voltages can be experienced.

Although the batteries are sealed, any damage to the casing or seals can result in the release of electrolyte. The electrolyte is corrosive, so avoid any contact with clothes or the skin.

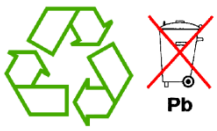
The hazardous energy levels due to the high short circuit currents can be a danger
Remove watches, rings and other metal attire, before working on the battery
Use Insulated tools when working on the batteries

Wear eye protection when working with the batteries. This is particularly important to prevent damage to the eyes if the battery is accidentally shorted during the installation. The vaporised metal can scorch the eye surface.

Clean all acid splash in the eyes or on the skin with generous quantities of water, and then seek immediate medical help.

Acid on clothing needs to be washed immediately in water.

The hazardous energy levels due to the high short circuit currents can mean a risk of explosion or fire. Burns need to be cooled immediately and for as long as possible, while seeking medical help.



These batteries contain lead. Re-cycle scrap batteries.

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Unpacking

It is advisable to unpack all the cells or mono-blocks and accessories before commencing with the installation.

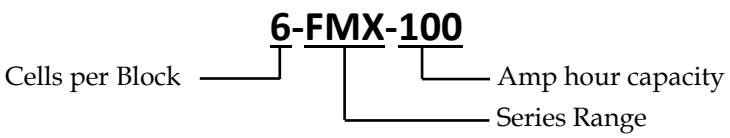
All cells/units should be handled carefully as the container can be damaged or broken if roughly handled. Under no circumstances should they be dropped or lifted by their terminal posts.

All items should be carefully checked against the accompanying delivery documentation to ascertain if any are missing and also inspected to see whether any are damaged or broken. Should you have any concerns please contact the Sales Department at Enervision (Pty) Ltd for assistance.

The parts supplied with this battery are as contained with your delivery documentation, either on the delivery note or as a separate parts list.

Block Numbering

The block numbering is as follows:



Reporting Problems with This Guide

Please use the fax or email addresses below to report any problems you find in this guide.

Enervision Technical Services

TEL: 086 111 1270

EMAIL: sales01@enervision.co.za

For Further Information and Technical Assistance

Enervision (Pty) Ltd recognizes the need to keep you informed about the availability of current product information.

For up-to-date product information and a complete listing of sales offices, visit the Enervision website at: **http://www.enervision.co.za**

For comprehensive product data sheets, Product Guides and application notes please contact your local Enervision representative or email: **sales01@enervision.co.za**

For technical assistance, contact your local Enervision representative in the first instance, alternatively phone 0861 111 270 or email **sales01@enervision.co.za**

Storage

Batteries should be stored in a clean dry place. For best performance of the batteries, it is recommended that the batteries are stored in a cool environment, where all blocks required for an installation are kept in a homogeneous environment.

Storage Times vs. Storage Temperature

As the batteries are supplied charged and the batteries will inherently self discharge, storage time is limited. In order to easily charge the batteries after prolonged storage, it is advised not to store the batteries without a refresher charge for more than:

- 6 months at 20 °C
- 3 months at 30 °C
- 1.5 months at 40 °C

Avoid storing the batteries in an area where they can be exposed to direct sunlight, organic solvents or corrosive gases.

If the blocks are removed from the boxes, they should not be stacked.

Transportation

When transporting the batteries ensure that they are not subjected to undue pressure differentials that could cause the safety valves to operate.

Batteries should be transported in their boxes, with the terminal protection fitted.

Batteries should be transported upright and be well secured so that they do not roll or bump into anything during transport.

If they are not in their boxes, the batteries should not be stacked during transport.

State of Charge

The battery state of charge can be determined by measuring the open-circuit voltage of the cells in rest position (having not been on charge or discharged for 24 hours at 20 °C).

State of Charge	Rest Voltage (20 °C)
100%	2.18 Vpc
80%	2.13 Vpc
60%	2.08 Vpc
40%	2.03 Vpc
20%	1.99 Vpc

The rest voltage variation given above can be as much as 2.5 mV per 10 °C

Recharge of Stored Batteries

A refreshing charge must be performed if the State of Charge drops below 80% (see table above) or at least after the times given under storage times vs. storage temperature above. This charge should be at 2.23 to 2.28 volts per cell at 25 °C for 48 to 96 hours. Current limiting during the charge is not essential, but for optimum charge efficiency the current output of the charger can be limited to 10% of the 10 hour capacity rating.

Failure to observe these conditions may result in greatly reduced capacity and service life.

Installation

Install batteries in a clean dry area, out of direct solar radiation, organic solvents or corrosive gases. Shoto SLA products release minimal amounts of gas during normal operation (gas recombination efficiency ≥ 95%). Batteries must be installed in accordance with national standards (for instance EN 50272-2), otherwise in accordance with the manufacturer's instructions.

Temperature

Avoid placing the battery in a hot place or in front of a window. The battery will give its best performance and service life when working at a temperature between 20 °C and 25 °C. The extreme operating temperature is between – 10 °C and + 35 °C and will have a detrimental effect on the life and performance. At lower temperatures the capacity will be less, and at higher temperatures the ageing process (and thus the life) will be accelerated.

The battery needs to be maintained in a homogeneous environment to ensure that all cells do not drift apart during the usable life. Avoid allowing heat (e.g. sun from a window) sources or cooling sources (e.g. an air conditioner or ventilation outlet) to blow directly on a section of the battery.

Temperature compensated float charging should be used if extreme or variable temperatures of the battery environment is experienced.

Ventilation

Under normal conditions gas release is very low and natural ventilation is sufficient for both cooling purposes and gas release during inadvertent overcharge, enabling Shoto SLA batteries to be used safely in offices and with main equipment. It is not recommended that batteries be placed in sealed rooms.

Care must be taken to ensure adequate ventilation when placed in cabinets. Batteries must not be placed in closed cabinets without ventilation openings.

Mounting

In multi floor buildings, the design of the floor and structure must be checked, and confirmed that it will support the weight of the batteries in the proposed layout.

Enervision (Pty) Ltd modular battery stands or cabinets are recommended when installing the cells. Assemble the stand according to instructions. Place the blocks or cells on the stand and arrange the positive and negative terminals for connection according to the wiring diagram. Check that all contact surfaces are clean and apply the block connectors and the terminal screws in the sequence starting with the equalising connector against the post, inter block connecting strap, tabbed washer (for monitoring if required), spring washer and nut. Tighten the screws securely by hand before tightening as discussed below. Finally connect the battery takeoff terminals. It is important that the battery is mounted firmly, and the pole faces are in the same plane to avoid stress on the post seal.

Note: In order to avoid damage, it is recommended that open circuit float voltages are taken before the battery is connected to the charger system. The arithmetic total of all the block voltages should equal the overall measured voltage, and should approximate to 12 x the number of blocks in a series string. All series strings connected together in parallel must have the same number of blocks.

Torque

Tighten the nuts or bolts to the recommended levels of fastening torque as specified below for the metric thread size of the terminal. A loose connector can cause problems in the charger adjustment, erratic battery performance, and possible damage to the battery and/or personal injury. An over tightened connector can cause damage to the post, stripping of the thread or stretching of the brass insert inside the lead post.

Finally fix the connector covers if supplied.

Note: It is recommended that if the battery is placed on an open stand that connector covers are used. Batteries in cabinets or in rooms where access is controlled and the safety risk is low, the use of connectors is optional.

Thread Size	Torque
M6	8.5 Nm
M8	9.5 to 10.5 Nm

Blocks connected in series

The number of blocks used in series is determined by the DC voltage required. The number of cells in series (N) will not affect the float voltage per cell.

Therefore, the charging float voltage = N x per Cell float voltage.

No special circuit arrangements are required.

To avoid circuit voltage losses from affecting the battery performance, care should be taken to ensure that the cross-sectional area inter cell, inter row, and inter shelf is sufficient to handle the currents. The cable length between the battery and load should be kept as short as possible, and cable voltage drop should be managed. Typically the voltage drop across any connector should be less than 10 mV.

Blocks connected in parallel

Where blocks are connected in parallel, the identical block type and number of blocks must be used for each string.

When using constant voltage chargers ensure connections made between the charger and batteries have the same electrical circuit resistance.

Although no special circuit arrangements are required, where the parallel connection is made at the charger or distribution board, to avoid out of step conditions, the busbar run length and area of cross section should be designed so that the circuit resistance value for each circuit is equal within the limits of ± 5%.

Cell Numbering

Self-adhesive number labels are supplied; one for each cell or mono-block, i.e. only one label for each unit, and these should be fixed to the cell lid cover. It is important that the surface is clean and dry before fitting the label which is done by removing the backing paper, placing the label in position and applying even pressure to the whole of the label.

Do not obstruct the vent holes or vent cover with the block number.

It is standard to number the cells or blocks beginning with No 1 at the positive end of the battery. This is particularly important to reference the block when recording data during monitoring.

Continue numbering consecutively by following exactly the electrical connections right through to the negative end of the battery.

Strings in parallel are generally numbered from the nearest string to the furthest string. Letters can be used for string numbering.

General Recommendations

- Do not wear clothing of synthetic material to avoid static generation.
- Use only a clean soft damp cloth for cleaning the blocks. Do Not use chemicals or detergents.
- Use insulated tools.
- Commence installation at the least accessible point.
- Consult the drawing for correct position of the block polarity and battery takeoff points.

Commissioning Charge

Ensure that the batteries will be operated in a clean environment.

Before connecting the battery to the charging equipment or the load, record the open circuit voltages of all the blocks, and then confirm that the sum of the open circuit voltage is equal to the total string voltage. Ensure that the charging system is rated and correctly calibrated to charge the battery in the assembled configuration and at the average environmental temperature of the battery installation.

The purpose of the commissioning charge is to ensure that the blocks are equalised, and all blocks reach 100% state of charge before the battery is subjected to discharges. This is achieved by float charging the battery for a prolonged period of time or by raising the charge voltage to force an equalise current into the lower capacity blocks. This latter method can result in a degree of overcharge, and should thus only be used if constantly monitored by competent personnel.

Before doing any capacity testing on the battery, a commissioning charge is recommended to ensure adequate performance of the battery.

Before use, the batteries should be charged at a constant float voltage adjusted to the ambient temperature, e.g. 2.23 volts per cell at 25 ^{o}C for 48 to 96 hours. Alternatively, a voltage of 2.35 volts per cell with a current limit of 0.2C can be used to reduce the time of the commissioning. The conditions in Table under balancing charge should be used to terminate the charge elevated charge voltage.

Where the batteries have been stored under harsh conditions, this increased voltage can be particularly effective.

Charging during Normal Operation

Float Voltage

Setting the float voltage correctly is critical to both the performance and the life of the battery.

At normal room temperature (25 ^{o}C), the recommended float voltage is equal to 2.23 volts per cell or 13.38 volts per block.

To optimise the performance it is recommended that the float voltage is adjusted for room ambient temperatures in accordance with the following table.

The table contains a range of voltages for each temperature. If the battery is charged for long periods of time without a discharge, then it is recommended that the lower value in the range is used. Where the battery is subjected to frequent discharges without a long period of float charge, the blocks can go out of step. Then it is recommended that the float voltage is increased to improve equalise charge. Increasing the float voltage if applied incorrectly will result in a degree of overcharge, and can affect the service life of the battery. Please consult Enervision (Pty) Ltd before attempting this.

Temperature	Float Voltage Range per Cell
5 ^{o}C	**2.275 to 2.325 Volts per cell**
10 ^{o}C	**2.260 to 2.310 Volts per cell**
20 ^{o}C	**2.245 to 2.295 Volts per cell**
25 ^{o}C	**2.230 to 2.280 Volts per cell**
30 ^{o}C	**2.215 to 2.275 Volts per cell**

Under these conditions a recharge will be completed in approximately 72 hours

Charging Current

A discharged VRLA battery will accept a high recharge current. It is recommended that the recharge be limited to 0.2 C_{10} to avoid heat build-up inside the battery

Note: For a completely discharged battery, 80% of the capacity is replaced in approximately:

- *10 hours at 0.1 C_{10}*
- *6 hours at 0.2 C_{10}*
- *5 hours with no current limit applied*
- *It is necessary to replace a greater amount of energy (Ah) during charge than was taken out of the battery during discharge.*

Balancing Charge (Note: Excessive charge will be detrimental to service life)

Increasing the charge voltage to 2.35 Volts per cell can reduce recharge time and it is possible, depending on the depth of discharge, to reduce the recharge time. Under these conditions, however, the charge must be monitored and must be terminated when the conditions in the table below are met.

Balancing Charge Parameters

Balancing Charge Condition		Balancing charge time	Condition to exit
1	Before operation and after installation and inspection of the battery	1 to 10 hours depending on the balancing current value during the process	Balancing current is less than 10 mA per Ah
2	When the charge current after a power outage is greater than 50 mA per Ah	1 to 10 hours depending on the balancing current value during the process	Balancing current is less than 10 mA per Ah
3	After a capacity test on the battery	1 to 10 hours depending on the balancing current value during the process	Balancing current is less than 10 mA per Ah
4	When the float voltage drops below 2.18 Volts per cell	10 hours	Time expires, and the battery is returned to float voltage
5	Periodically every 6 months	10 hours	Time expires, and the battery is returned to float voltage

This charge regime, in order to achieve a normal service life, must not be used more than once per month.

During fast charge adequate ventilation must be provided to ensure that there is no excessive gas build-up around the battery.

Float Charge Ripple

Excessive ripple on the DC supply across a battery has the effect of reducing life and performance.

It is recommended that voltage regulation across the system, including the load but without the battery connected, under steady state conditions, shall be better than ±1% from 5% to 100% load.

In any event, the float charge current must not reverse as this will cause micro cycling of the batteries and will affect the service life of the batteries.

Manual or Periodic Equalise

If maintenance checks reveal a slow divergence of the cell voltages, a manual or periodic equalize charge at 2.35 volts per cell can be applied using the parameters in the table under balancing charge above.

During equalise charge adequate ventilation must be provided to ensure that there is no excessive gas build-up.

Discharging

! Do Not Leave Batteries in a Discharged Condition

Shoto SLA Batteries must not be left in a discharged condition after supplying the load, but must as soon as possible return to float charge mode.

Failure to observe these conditions may result in greatly reduced service life.

Accidental deep discharge

Deep discharge occurs when the battery is subjected to a discharge at:

- A lower current, for a longer period than the original specification.
- Failure of the control system allowing the battery to be discharged beyond the original specification.
- Battery is not recharged immediately after a discharge.

For optimum operation the minimum voltage of the system should be related to the duty as follows:

Duty	Minimum end voltage
5 min ≤ t ≤ 1 hour	1.70 Volts per cell
1 hour ≤ t ≤ 5 hour	1.75 Volts per cell
5 hour ≤ t ≤ 8 hour	1.80 Volts per cell
8 hour ≤ t ≤ 20 hour	1.85 Volts per cell

In order to protect the battery it is advisable to have system monitoring that has a low voltage cut-out of the battery. This cut-out should remove the complete load from the battery if immediate steps are not available to recharge the battery.

Deep discharge will produce a premature deterioration of the battery and a noticeable reduction in the life expectancy of the battery. It may also result in problems in initially getting the battery to accept charge.

When a battery is completely discharged:

- The utilisation of the sulphuric acid in the electrolyte is total and the electrolyte then consists only of water. During recharge this condition may produce metallic dendrites which can penetrate into the separator and cause an increase in the self-discharge current or cause a short circuit in a cell.
- The sulphating of the plate is at its maximum and the internal resistance of the cell is at a maximum. The battery needs to be recharged at a constant potential of 2.23 Volts per cell with the current limited to a maximum of 0.1 C_{10} in order to prevent excessive internal heating.

In order to establish if any detrimental effect is evident after a deep discharge, it is recommended that a full investigation of the battery performance and cell divergence be carried out.

The Effect of Temperature on Capacity

The correction factors of capacity, according to temperature are as follows:

Discharge Time	-15°C	-10 °C	-5 °C	0°C	5°C	10°C	15°C	20°C	25°C	30°C	35°C
1 Hour	0.06	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00	1.05	1.10
3 Hour	0.68	0.72	0.76	0.80	0.84	0.88	0.92	0.96	1.00	1.04	1.08
10 hour	0.76	0.79	0.82	0.85	0.88	0.91	0.96	0.97	1.00	1.03	1.06

The Effect of Temperature on Life

Operation of valve regulated batteries at temperatures higher than 25 °C will reduce life expectancy. Life is reduced by approximately 50% for every 10 °C rise in the yearly average ambient temperature above 25 °C. Decreasing the temperature below 25 °C will not improve the life expectancy.

Temperature	Percentage decrease in Service Life
25 °C	**0**
30 °C	**30**
35 °C	**50**
40 °C	**66**
45 °C	**75**
50 °C	**83**

Electro-Magnetic Compatibility (EMC)

Vision SLA products are covered by the EMC statement in EN 50226:1995 which reads as follows:

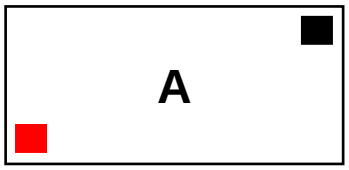
Rechargeable cells or batteries are not sensitive to normal electromagnetic disturbances, and therefore no immunity tests shall be required. Free-standing rechargeable cells or batteries electrically isolated from any associated electrical system are for all practical purposes electrically inert, and therefore the requirements for electrolytic compatibility shall be deemed to be satisfied.

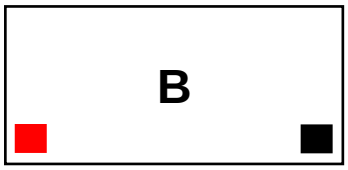
Note: It should be noted that rechargeable cells or batteries are part of an electrical system, and the manner in which they are used could invoke the requirements of electromagnetic compatibility upon the system. In such cases, the requirements of the electromagnetic compatibility shall be accommodated by the design of the system.

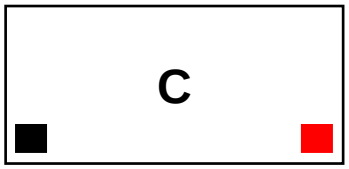
6-FMX Series - Dimensions and Weights

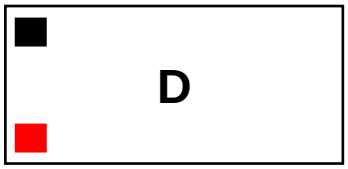
Battery Type	Nom Volts	Capacity (Ah) 1.8Vpc @ 10 Hr 25°C	L (mm)	W (mm)	H (mm)	TH (mm)	Wt (kg)	Terminal
6-FMX-50	12	50	390	105	200	200	21	M6-D
6-FMX-100A	12	100	520	110	254	254	38	M6-D
6-FMX-100B	12	100	395	110	286	286	33	M6-D
6-FMX100C	12	100	559	115	227	227	37	M8-D
6-FMX-150A	12	150	559	125	310	310	55	M8-D
6-FMX-150B	12	150	550	110	310	310	50	M6-D
6-FMX-180	12	180	559	125	315	315	57	M8-D

Terminal Positions









6-FMX Series - Discharge Performance Tables

Constant Current Discharge (Amperes) at 25 °C to 1.70 Volts per Cell										
	Standby Time in Minutes									
Battery Type	30 min	1 hour	2 hour	3 hour	4 hour	5 hour	6 hour	8 hour	10 hour	12 hour
6-FMX-50	51.0	28.4	18.6	13.3	10.6	9.0	7.7	6.3	5.3	4.7
6-FMX-100A	110	61.3	40.1	25.5	20.4	17.3	15.9	12.8	10.2	8.9
6-FMX-100B	106	58.9	38.5	25.5	20.4	17.3	15.3	12.3	10.2	8.6
6-FMX100C	109	60.7	39.7	25.5	20.4	17.3	15.7	12.7	10.2	8.8
6-FMX-150A	160	89.3	58.4	38.0	30.4	25.8	22.9	18.5	15.2	12.8
6-FMX-150B	158	88.4	57.8	38.0	30.4	25.8	22.7	18.3	15.2	12.7
6-FMX-180	190	106	69.3	52.0	41.2	32.2	27.5	22.1	18.4	15.5

Note: Please refer to the Website latest Product Guide for the most up to date discharge information.

Constant Power Discharge (Watts per cell) at 25 °C to 1.70 Volts per Cell										
	Standby Time in Hours									
Battery Type	30 min	1 hour	2 hour	3 hour	4 hour	5 hour	6 hour	8 hour	10 hour	12 hour
6-FMX-50	92.5	52.8	35.6	27.6	23.0	18.2	16.1	12.7	10.9	9.1
6-FMX-100A	199	113.8	76.7	59.1	49.3	36.9	31.8	25.5	21.2	17.7
6-FMX-100B	184	107	73.4	56.0	45.1	35.2	30.5	24.4	20.2	16.9
6-FMX100C	197	113	75.9	58.5	48.8	36.5	31.5	25.2	21.0	17.5
6-FMX-150A	290	166	112	86.2	65.2	54.3	45.1	37.0	30.7	25.7
6-FMX-150B	288	164	111	85.3	64.6	53.8	44.7	36.6	30.4	25.4
6-FMX-180	345	197	132	102	82.1	64.1	55.4	44.3	36.7	30.8

Note: Please refer to the Website latest Product Guide for the most up to date discharge information.

6-FMX Series - Discharge Performance Tables

Constant Current Discharge (Amperes) at 25 °C to 1.75 Volts per Cell										
	Standby Time in Minutes									
Battery Type	30 min	1 hour	2 hour	3 hour	4 hour	5 hour	6 hour	8 hour	10 hour	12 hour
6-FMX-50	48.3	27.6	18.3	13.0	10.4	8.8	7.6	6.2	5.2	4.5
6-FMX-100A	104	59.3	39.6	25.3	20.2	17.2	15.8	12.7	10.1	8.8
6-FMX-100B	100	57.0	38.1	25.3	20.2	17.2	15.2	12.2	10.1	8.5
6-FMX100C	103	58.7	39.2	25.3	20.2	17.2	15.6	12.6	10.1	8.7
6-FMX-150A	151	86.5	57.7	37.8	30.2	25.7	22.7	18.4	15.1	12.7
6-FMX-150B	150	85.6	57.1	37.8	30.2	25.7	22.5	18.2	15.1	12.6
6-FMX-180	180	102	68.6	50.9	40.7	31.9	27.4	22.0	18.2	15.3

Note: Please refer to the Website latest Product Guide for the most up to date discharge information.

Constant Power Discharge (Watts per cell) at 25 °C to 1.75 Volts per Cell										
	Standby Time in Hours									
Battery Type	30 min	1 hour	2 hour	3 hour	4 hour	5 hour	6 hour	8 hour	10 hour	12 hour
6-FMX-50	88.6	51.9	35.4	27.3	22.9	18.1	15.9	12.4	10.6	8.9
6-FMX-100A	191	111	76.3	58.2	48.6	36.6	31.4	25.3	21.0	17.6
6-FMX-100B	184	107	73.4	56.0	45.1	35.2	30.5	24.4	20.2	16.9
6-FMX100C	189	111	75.5	57.6	48.1	36.2	31.1	25.0	20.8	17.4
6-FMX-150A	278	163	111	84.9	64.6	53.9	44.8	36.8	30.5	25.6
6-FMX-150B	276	161	110	84.1	64.0	53.4	44.4	36.4	30.2	25.3
6-FMX-180	330	193	132	100	81.2	63.4	54.9	43.9	36.4	30.4

Note: Please refer to the Website latest Product Guide for the most up to date discharge information.

6-FMX Series - Discharge Performance Tables

Constant Current Discharge (Amperes) at 25 °C to 1.80 Volts per Cell										
	Standby Time in Minutes									
Battery Type	30 min	1 hour	2 hour	3 hour	4 hour	5 hour	6 hour	8 hour	10 hour	12 hour
6-FMX-50	45.6	27.0	18.1	12.5	10.0	8.5	7.5	6.1	5.0	4.4
6-FMX-100A	98.4	58.0	39.1	25.0	20.0	17.0	15.6	12.6	10.0	8.7
6-FMX-100B	94.6	55.9	37.6	25.0	20.0	17.0	15.1	12.1	10.0	8.4
6-FMX100C	97.4	57.4	38.7	25.0	20.0	17.0	15.4	12.5	10.0	8.6
6-FMX-150A	143	84.6	57.1	37.5	30.0	25.5	22.5	18.3	15.0	12.6
6-FMX-150B	142	83.8	56.5	37.5	30.0	25.5	22.3	18.1	15.0	12.5
6-FMX-180	170	100	67.7	49.9	40.0	31.5	27.2	21.8	18.0	15.1

Note: Please refer to the Website latest Product Guide for the most up to date discharge information.

Constant Power Discharge (Watts per cell) at 25 °C to 1.80 Volts per Cell										
	Standby Time in Hours									
Battery Type	30 min	1 hour	2 hour	3 hour	4 hour	5 hour	6 hour	8 hour	10 hour	12 hour
6-FMX-50	84.8	51.3	35.2	27.1	22.7	18.1	15.8	12.2	10.5	8.8
6-FMX-100A	182	110	75.9	57.3	48.0	36.2	31.1	25.2	20.9	17.4
6-FMX-100B	176	106	73.0	55.1	44.5	34.9	30.2	24.2	20.1	16.8
6-FMX100C	181	109	75.1	56.7	47.5	35.8	30.8	24.9	20.7	17.2
6-FMX-150A	266	161	110	83.5	63.7	53.3	44.4	36.7	30.4	25.5
6-FMX-150B	254	159	109	82.7	63.1	52.8	44.0	36.3	30.1	25.2
6-FMX-180	316	191	131	99.2	80.1	62.8	54.4	43.6	36.2	30.2

Note: Please refer to the Website latest Product Guide for the most up to date discharge information.

6-FMX Series - Discharge Performance Tables

Constant Current Discharge (Amperes) at 25 °C to 1.85 Volts per Cell										
	Standby Time in Minutes									
Battery Type	30 min	1 hour	2 hour	3 hour	4 hour	5 hour	6 hour	8 hour	10 hour	12 hour
6-FMX-50	42.1	25.1	17.8	12.0	9.6	8.2	7.3	5.8	4.8	4.2
6-FMX-100A	90.8	54.0	38.3	24.5	19.6	16.7	15.4	12.4	9.8	8.5
6-FMX-100B	87.3	51.9	36.9	24.5	19.6	16.7	14.9	11.9	9.8	8.2
6-FMX100C	89.9	53.5	37.9	24.5	19.6	16.7	15.2	12.3	9.8	8.4
6-FMX-150A	132	78.7	55.9	36.8	29.4	25.0	22.3	18.1	14.7	12.5
6-FMX-150B	131	77.9	55.3	37.0	29.6	25.2	22.1	17.9	14.8	12.4
6-FMX-180	157	93.4	66.4	48.8	39.2	31.0	26.8	21.4	17.6	14.8

Note: Please refer to the Website latest Product Guide for the most up to date discharge information.

Constant Power Discharge (Watts per cell) at 25 °C to 1.85 Volts per Cell										
	Standby Time in Hours									
Battery Type	30 min	1 hour	2 hour	3 hour	4 hour	5 hour	6 hour	8 hour	10 hour	12 hour
6-FMX-50	80.2	48.4	34.8	26.8	22.4	17.9	15.5	11.8	10.4	8.6
6-FMX-100A	173	104	74.9	56.5	47.3	35.8	30.6	25.0	20.5	17.2
6-FMX-100B	166	100	72.1	54.3	43.8	34.4	29.8	24.0	19.8	16.5
6-FMX100C	171	103	74.2	55.9	46.8	35.4	30.3	24.8	20.3	17.0
6-FMX-150A	252	152	109	82.3	62.8	52.6	43.9	36.5	30.2	25.3
6-FMX-150B	249	150	108	81.5	62.2	52.1	43.5	36.1	29.9	25.0
6-FMX-180	299	180	129	97.7	78.8	61.9	53.6	43.2	35.6	29.7

Note: Please refer to the Website latest Product Guide for the most up to date discharge information.

Warranty Policy

Enervision (Pty) Ltd warrants its equipment against defects in materials or workmanship. The term of the warranty shall be as stated in the Contract of Sale for the equipment. In the absence of any such statement in the Contract of Sale, the term of this warranty shall be one year from the date of the initial sale. Warranty only applies to the original sale to the end user. It does not apply to pre-used equipment.

This warranty is void in any of the following circumstances:

a) The equipment has not been paid for in full
b) The equipment has been misused, neglected, damaged or abused
c) The equipment has been improperly installed, repaired or maintained (this includes temperature and ventilation requirements)
d) The equipment has been modified (e.g. Additives put onto vented cells)
e) The equipment has been connected to other equipment which is not compatible
f) The equipment has been stored in conditions outside the electrical and environmental specifications (this includes periods between refresher charge in batteries)
g) The equipment has been used for purposes other than for which it was designed
h) The equipment has been used outside its stated specifications and operating parameters (this includes cycling and DOD in battery applications

Unless otherwise provided in the contract of sale, correct installation is the owner's responsibility. The equipment must be installed in accordance with the installation procedures in the relevant supporting documentation. Failure to follow such installation procedures may, at the manufacturer's discretion, render this warranty null and void. The manufacturer shall not be liable if the equipment has been altered, damaged or rendered non-functional through incorrect installation.

The manufacturer does not warrant any modules or components manufactured by third parties. However, the manufacturer shall extend to the owner, in as far as practicable, the benefit of any warranties that such party manufactures may have given to the manufacturer concerning such modules and components.

To assert a warranty claim, contact the manufacturer or his authorised service agent detailing the nature of the claim. If the manufacturer intends to consider the warranty claim, he will instruct the owner on the way to proceed. The manufacture may choose to send a factory representative to inspect the claim, or may request the goods to be returned to the manufacturer or the authorised service agent. Wherever possible, use the original packaging to return the goods. The manufacturer may request proof or purchase.

If the manufacturer accepts the warranty claim, the manufacturer will provide, or arrange for, service, repair or replacement, as the manufacturer shall determine in its sole discretion. The manufacturer shall bear the cost of such service, repair or replacement. The owner shall bear the cost of freight and insurance on the equipment to the manufacturer or its authorised agent, as the case may be. The manufacturer shall bear the cost of freight and insurance to return the equipment to the owner.

The manufacturer's sole responsibility is to repair, replace or service equipment subject to a valid warranty claim. Under no circumstances will the manufacturer be liable for direct, indirect, incidental, special or consequential costs or damages, including dismantling and re-installation costs, loss of operations or profits, to the maximum extent permitted by law.

The manufacturer accepts no liability for personal injury or damage resulting from failure to heed relevant installation, operating and safety procedures specified by the manufacturer or imposed by law.

Some jurisdictions do not allow limitations of disclaimers of implied or statutory warranties. Some jurisdictions do not allow disclaimers or exclusions of consequential damages. Therefore, the above disclaimers, limitations and exclusions may not apply in all jurisdictions in which the manufacturer sells the equipment.

This warranty gives the owner specific legal rights. The owner may have other rights or remedies pursuant to the laws in its territory. Nothing in this limited warranty should be construed as limiting or restricting any other statutory right or remedy of the owner, except for such limitations or restrictions herein as may be allowed by the law of the territory.

The manufacturer has a policy of continual improvement and specifications are subject t to change without notice.

Maintenance and Routine Checks

Vision SLA batteries are maintenance free, sealed, lead acid batteries and need no water addition during their service life.

Cleaning

The containers and lids shall be kept dry and free from dust. Cleaning must be done only with a damp cotton cloth. Do not use any detergents.

Checks

Installation

1. The room is at the correct ambient temperature.
2. The vent caps are correctly seated and are not lose.
3. There are no cracks in the battery casing.
4. Check that the cells or blocks are connected according to the drawings provided.
5. Check that the deflection of the battery shelf is less than 5mm in the middle.
6. Check that the cells or blocks are all connected with the correct polarity.
7. Check that all terminals are tightened to the correct torque value.
8. Check that all the strings have a similar resistance path.
9. Measure and record the individual cell or block voltages in the log sheets provided. Block voltages should be between 12.80 and 13.50 volts
10. Confirm that the arithmetic sum of the cell or block voltages equals the overall string voltage.
11. Check that the total string voltages are N x average cell or block voltage.
12. Check that the charger system is fully functional and correctly calibrated before connecting the battery to the charger.
13. Check that the charger voltage is set to N x temperature compensated voltage as shown on page 8.
14. Check the charger voltage is equal to the sum of the individual cell voltages.
15. Before putting the battery on charge, check that there are no links, tools or other objects on the batteries
16. Place the battery on charge for a continuous period of 96 hours before connecting the load and doing any capacity tests on the battery.
17. Log a capacity test on the battery using the typical discharge rate, either manually (recording the cell voltages as per appendix A) or using the battery management system to record a characterisation of the battery.

During the first Three Months of Service

1. Clean of any dust or dirt on the battery or the terminals.
2. Every month check that the total voltage at the battery terminals is N x 2.25 Volts @25 ^{o}C. ***Please refer to the table on page 8 for different ambient temperatures.***
3. Every month take the individual cell or block voltages in the battery. A variation of ± 4.5% (100 mVolts per cell from the average is acceptable)

   Due to the recombination process the variation in cell voltages may be higher when the battery is first put into service.

4. Check that the connectors are torqued to the correct settings. See the table on page 6
5. Record all readings in the Log Sheets in the appendix

During the balance of the First Year of Service

1. Every visit, Clean of any dust or dirt on the battery or the terminals
2. Every month check that the total voltage at the battery terminals is N x 2.25 Volts @25 °C ***Please refer to the table on page 8 for different ambient temperatures.***
3. Every third month take the individual cell or block voltages in the battery. A variation of ± 3.5% (100 mVolts per cell from the average is acceptable)
4. Every third month, check that the connectors are torqued to the correct settings. See the table on page 6
5. Once during the year, do a partial discharge test where 25 to 30% capacity is removed at the typical discharge rate from the battery. Compare these results to the Characterisation Test done at installation
6. Record all readings in the Log Sheets in the appendix

During the Rest of the Serviceable Life of the Battery

1. Every Visit, Clean of any dust or dirt on the battery or the terminals
2. Every third month check that the total voltage at the battery terminals is N x 2.25 Volts @25 °C. ***Please refer to the table on page 9 for different ambient temperatures.***
3. Twice per year, take the individual cell or block voltages in the battery. A variation of ± 4.5% (100 mVolts per cell from the average is acceptable)
4. Once per year, check that the connectors are torqued to the correct settings. See the table on page 6
5. Every second year, Log a partial capacity test on the battery using the typical discharge rate, either manually (recording the cell voltages as per appendix A) or using the battery management system to record a characterisation of the battery
6. When required Log a capacity test on the battery using the typical discharge rate, either manually (recording the cell voltages as per appendix A) or using the battery management system to record a characterisation of the battery
7. Record all readings in the Log Sheets in the appendix

Battery Inspection Record **(Year One)**

Block No	O/C	Month1	Month2	Month3	Month4	Month5	Month6	Month7	Month8	Month9	Month10	Month11	Month12
1													
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3													
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27													
28													
29													
30													
31													
32													
33													
34													
35													
Overall													
Torque													
Clean Battery													
Engineer													
Date													

Areas greyed out need not be completed at the scheduled site inspection

Battery Inspection Record (years 2 to 10)

	Year 2				Year 3				Year 4			
Block No	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q
1												
2												
3												
4												
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27												
28												
29												
30												
31												
32												
33												
34												
35												
String Overall												
Torque												
Clean Battery												
Engineer												
Date												

Areas greyed out need not be completed at the scheduled site inspection

Battery Inspection Record (years 2 to 10)

	Year 5				Year 6				Year 7			
Block No	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q
1												
2												
3												
4												
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28												
29												
30												
31												
32												
33												
34												
35												
String Overall												
Torque												
Clean Battery												
Engineer												
Date												

Areas greyed out need not be completed at the scheduled site inspection

Battery Inspection Record (years 2 to 10)

	Year 8				Year 9				Year 10			
Block No	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q
1												
2												
3												
4												
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32												
33												
34												
35												
String Overall												
Torque												
Clean Battery												
Engineer												
Date												

Areas greyed out need not be completed at the scheduled site inspection

Battery Discharge Record

Works Order No	Customer Ref	
Battery Installed at		Battery Type
No of Cells/Mono-blocks per String		Date Installed
Battery Float Voltage	Ambient Temperature	Charger Type
Average Volts per Cell	Battery Charge Current	Start of Charge Date
Comments		
Engineer in Charge		Date of Test

Block No	Relax Volts	O/C Volts									
1											
2											
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31											
32											
33											
34											
35											
String											
			Engineer in Charge					Date of Test			

*Relax volts is the Voltage on the cell after installation, **before** the battery is put on **charge** or **discharge**.*

O/C Volts is the Voltage after the battery has been standing for 10 minutes with the charger off, before the discharge test is started

5 min is 5 minutes after the discharge has started

x hr is x hours after the discharge has started

Battery Discharge Record

Works Order No	Customer Ref	
Battery Installed at		Battery Type
No of Cells/Mono-blocks per String		Date Installed
Battery Float Voltage	Ambient Temperature	Charger Type
Average Volts per Cell	Battery Charge Current	Start of Charge Date
Comments		
Engineer in Charge		Date of Test

Block No	Relax Volts	O/C Volts									
1											
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31											
32											
33											
34											
35											
String											
			Engineer in Charge					Date of Test			

*Relax volts is the Voltage on the cell after installation, **before** the battery is put on **charge** or **discharge**.*

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Battery Discharge Record

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Battery Installed at		Battery Type
No of Cells/Mono-blocks per String		Date Installed
Battery Float Voltage	Ambient Temperature	Charger Type
Average Volts per Cell	Battery Charge Current	Start of Charge Date
Comments		
Engineer in Charge		Date of Test

Block No	Relax Volts	O/C Volts									
1											
2											
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35											
String											
			Engineer in Charge					Date of Test			

*Relax volts is the Voltage on the cell after installation, **before** the battery is put on **charge** or **discharge**.*

O/C Volts is the Voltage after the battery has been standing for 10 minutes with the charger off, before the discharge test is started

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Battery Discharge Record

Works Order No	Customer Ref	
Battery Installed at		Battery Type
No of Cells/Mono-blocks per String		Date Installed
Battery Float Voltage	Ambient Temperature	Charger Type
Average Volts per Cell	Battery Charge Current	Start of Charge Date
Comments		
Engineer in Charge		Date of Test

Block No	Relax Volts	O/C Volts									
1											
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35											
String											
			Engineer in Charge					Date of Test			

*Relax volts is the Voltage on the cell after installation, **before** the battery is put on **charge** or **discharge**.*

O/C Volts is the Voltage after the battery has been standing for 10 minutes with the charger off, before the discharge test is started

5 min is 5 minutes after the discharge has started

x hr is x hours after the discharge has started

Battery Discharge Record

Works Order No	Customer Ref	
Battery Installed at		Battery Type
No of Cells/Mono-blocks per String		Date Installed
Battery Float Voltage	Ambient Temperature	Charger Type
Average Volts per Cell	Battery Charge Current	Start of Charge Date
Comments		
Engineer in Charge		Date of Test

Block No	Relax Volts	O/C Volts									
1											
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String											
			Engineer in Charge					Date of Test			

*Relax volts is the Voltage on the cell after installation, **before** the battery is put on **charge** or **discharge**.*

O/C Volts is the Voltage after the battery has been standing for 10 minutes with the charger off, before the discharge test is started

5 min is 5 minutes after the discharge has started

x hr is x hours after the discharge has started

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