

OPERATION AND MAINTENANCE INSTRUCTIONS ENERGYSTORE

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SAFETY

Energystore batteries are heavy, so adequate mechanical handling systems must be used.

Care must be taken to ensure that the sulphuric acid electrolyte is not spilled and that the cells are not physically damaged.

Precautions:



SULPHURIC ACID BURNS:

Batteries contain sulphuric acid, which can cause burns and other serious injuries. In the event of contact with sulphuric acid, **FLUSH THOROUGHLY WITH WATER**. Seek medical attention **IMMEDIATELY**.



When working with batteries, always wear a rubber apron, rubber gloves and wear safety goggles or other eye protection. These will help to prevent injury if contact is made with the acid



ELECTROLYTE & ACID

Lead acid batteries contain diluted sulphuric acid, which is poisonous and corrosive. It will cause burns or irritation if it comes into contact with eyes or skin.

Precautions:

- When working on batteries always wear appropriate protective clothing, rubber apron, rubber gloves and eye protection.
- Handle batteries carefully and always keep them upright.
- Top up electrolyte in battery cells only to the correct level as recommended.

Emergencies:

- If acid is spilt on the floor, neutralise as quickly as possible using an alkali such as Soda Ash, sodium Bicarbonate or diluted Ammonia. Use copious quantities of water and dispose of the used neutralising agent carefully, consult Exide Technologies for any advice.
- If acid comes into contact with skin, wash off with plenty of clean water. If spilt on clothing, wash as soon as possible.
- If acid is splashed in eyes, immediately flood the eyes with copious quantities of clean water and seek medical attention.

.....Sulphuric acid will cause burns to eyes and skin.....



EXPLOSIONS

When lead-acid batteries are used and charged they produce hydrogen gas that is explosive.

Precaution:

- Always keep sparks, flames and cigarettes away from batteries to avoid ignition of any gases.
- Ensure connections are secure before turning the charger on. Use only insulated tools when working on batteries.
- Only use and charge batteries in areas that are adequately ventilated.



.....Energystore batteries give off explosive gases.

Charge with adequate ventilation.....



ELECTRICAL ENERGY

A battery can be short-circuited by simultaneously touching two or more of the cell terminals or inter-cell connectors with a metal tool or other conductive object. This will cause the object to become hot and eject molten metal and sparks which could ignite any hydrogen gas present, resulting in an explosion.

Precautions

- Before working with a battery, remove all metallic personal effects such as rings, watches and necklaces and anything, which may fall from pockets of clothing.
- Always use insulated tools and only use open ended type spanners.
- Do not place tools or other conductive objects on battery tops.
- Always wear eye protection.
- Ensure the electrical circuit is safe before making a connection to the battery.
- Ensure cable polarity is correct when fitting cables or connector plugs.
- Do not use metal jugs or vessels to store or dispense water or acid.

....Short circuits are responsible for burns and explosions.....



PREPARING THE BATTERY FOR SERVICE

On receipt:

- Examine carefully to see there is no transit damage or loss of components. Damage or loss should be reported to Exide Technologies immediately.
- Electrolyte level may settle down during transit and storage. Level should be assessed after the battery has been put on charge at ≥ 2.5 vpc and level adjusted if it is low.

Preparing the cells:

- Batteries may be put into service immediately providing the electrolyte specific gravity is above 1.230. If the electrolyte has a specific gravity of less than 1.230, the battery will require a charge.
- If not required for immediate service, the battery may be stored and should be given quarterly charges.
- During storage, replace evaporated water to ensure coverage of the battery plates.

Storage Information:

If the battery is not to be installed at the time of receipt it is recommended that it be stored indoors in a cool dry location. Do not stack pallets or possible battery damage could occur.

Please note that the rope handles on the baskets are provided to manoeuvre the batteries into position. These are not to be used for lifting the batteries.

GENERAL INSTALLATION CONSIDERATIONS

Battery location:

It is recommended that the battery be installed in a clean, cool dry location. Floors should be reasonably level and able to support the battery weight. A location having an ambient temperature of 25°C will result in optimum battery life / performance.

DO NOT ENCLOSE BATTERIES IN AIRTIGHT ENCLOSURES that prevent ventilation. This could cause a build up of explosive gases and overheating of the battery.

Allow adequate access for installation and periodic maintenance

Temperature variation:

Source of heating or cooling directed on portions of the battery can cause temperature variations within the strings. This could result in cell voltage differences and eventual compromise of battery performance.

Connecting cables:

Battery performance is based on the output at the battery terminals. Therefore, the shortest electrical connections between the battery system and the operating equipment should be used to maintain optimum efficiency of your installation.

Do not select cable sizes on current carrying capacity only, cable selection should allow for the lowest achievable voltage drop between the battery and operating system.

Where parallel strings are utilised, ensure that connecting cables are of equal size and length to ensure a balanced system.

Clean all connections before tightening (to 9 Newton metres) and take steps to minimise oxidation of terminals. An application of petroleum jelly to terminals will help to keep these connections clean.

Connection Check

Visually check all connections for a good tight connection and for correct polarity.

CHARGER CONNECTION

Ensure that the positive (+) terminal of the battery is connected to the positive (+) terminal of the charger and that the negative (-) terminal of the battery is connected to the negative (-) terminal of the charger. Damage or injury could result from incorrect connections.

COMMISSIONING OF DRYCHARGED ENERGYSTORE BATTERIES

1. Fill the cells with 1250 \pm 5 kg/m³ density @ 25°C. Fill level should be just under busbars.
2. After 1-hour soak, restore acid level. Check for any reverse cells by reading the voltage.
3. Place cells on charge at 0.06 C5 until acid density and voltage readings are constant at three consecutive hourly readings. This will take approximately 16 hours. Cell voltage should be \geq 2.60 vpc at top of charge.
4. Monitor cell temperature every 4 hours during charging. Should the temperature exceed 55°C, terminate the charge until the temperature has fallen to 45°C. The time the charge is OFF must be compensated for when it is returned.
5. At the completion of the charge period, read and record the pilot cell voltages, acid densities and temperature. At the completion of the charge period, check and adjust acid levels and density. If necessary, adjust cells to 1260 \pm 5 kg/m³ density @ 30°C.

CHARGING

Float Charge:

The suggested float charge voltage for these cells is **2.25 volts/cell @ 25°C**. Float charging is utilised where the battery is operated at no-load or light load applications.

Temperature compensation:

5.5 mV per degree C per cell is applicable for temp over 25C with minimum float volts of 2.21VPC.

Recharge following a cycle:

Following a discharge cycle it is recommended that the cells be recharged at **2.5-2.6 volts/cell @ 25°C**

Charge profiles

Charge profile could vary depending on the usage pattern and duty cycle. Please consult Exide Technologies, to obtain optimum charge profile, especially if Solar or Hybrid systems are in use.

ENERGYSTORE: Recommended charging parameters

Depth of Discharge	Solar or Hybrid System			Diesel Systems	
	Float volts VPC	Daily Recharge volts VPC	Absorption time Min	Daily Recharge volts VPC	Absorption time Min
Less than 10%	2.3	2.5	30 Min	2.5	60 Min
10-20%	2.35	2.5	60 Min	2.6	60 Min
20-30%	2.35	2.60	60 Min	2.65	90 Min

- If not connected to load, then the float voltage should be at 2.25 VPC.
- It is recommended that the discharge of ENERGYSTORE batteries should not exceed 30% except in emergencies (couple of times a year).
- Please consult Exide Technologies to obtain optimum charge profiles to suit the usage patterns.

Features of the Energystore Battery Range

The new ENERGYSTORE range of batteries especially designed for Remote Area Power Systems, in particular systems requiring optimum battery performance at the 100-hour rate has the following features:

1. **High-density polyethylene cases:**

Individual two-volt cells have their own polypropylene container and are then encased in a rugged polyethylene outer case. This design gives great strength and very high impact resistance rather than being aesthetically appealing and is designed to withstand transportation over difficult terrain and the rigours of outback life. The polyethylene is completely acid resistant so that corrosion of the case over the life of the battery does not occur.

The outer container is some 40-mm higher than the cell top to provide a measure of protection against accidental shorting during transportation and installation. All of the containers have handles fitted to allow manual lifting. The outer case ensures that the cell element compression meets the long life and vibration resistance requirements of this application and also acts as a spill tray.

2. **Increased electrolyte:**

The volume of electrolyte in the new range of cells increased by 50% compared with conventional cycling cells. This gives the cell three significant advantages:

Firstly, the 100-hour capacity is dramatically improved (by approx one third) with a proportional increase over short discharges. Secondly, the frequency of topping up is reduced and should only be required every 2 or 3 months, on new cells. Thirdly, there is an increased heat sink capability which gives ENERGYSTORE a greater resistance to high peak ambient temperatures, such as are commonly experienced in outback Australia.

3. **Great cycling capability**

The battery components are designed from the Exide Technologies advanced range of cycling cells. These cells are capable of delivering 1500 cycles to 80% depth of discharge and 2500 cycles to 50% depth of discharge. For discharges of 30%, 3500 can be expected, and in shallow cycle applications even greater cycling capabilities are achieved.

4. **Electrolyte density:**

The Electrolyte density of these cells is 1260 at 25°C (nominal).

5. **Acid level indication**

Each cell in the battery has its own level indicating vent plug. This vent plug is designed to make topping up both easy and accurate. When the electrolyte is topped up to the required level the float lifts up in the plug to indicate that filling is complete. The vent plug is designed to allow easy filling and reduce the incidence of spillage.

6. **Packaging**

The batteries are shipped to site strapped to solid wooden pallets. These pallets will facilitate handling of heavy batteries and minimise the risk of damage during transport and installation.

7. **Intercell connection protection**

Where these cells are to be installed in systems exceeding 100 volts there is a requirement for protection against accidental shorting and earth leakage. The intercell connectors are all safely shrouded to prevent problems.

8. Open circuit losses

With the alloys used in these cells the daily open circuit losses can be expected to be as low as 0.17%.

9. Optional Covers:

Optional plastic covers are provided. Please take care to install them on the batteries after maintenance and topup.

10. Recharging efficiency:

Recharging efficiency is extremely difficult to define, particularly in R.A.P.S. applications where the charge/cycle can be complex. The ampere-hour efficiency of recharging will be 80% to 95% of full charge, dependant upon recharge rates.

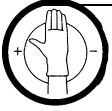
11. Made in Australia

The ENERGYSTORE range of batteries is manufactured by Exide Technologies Australia, to AS4086.1 under an AS9001 Quality Assurance standards scheme.

12. Recyclable

Over 97% of the battery is recyclable. All lead and plastic components can be reprocessed by Exide at the end of your battery's useful life.

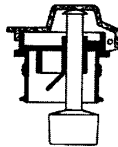
Maintenance



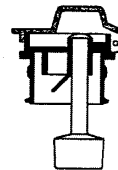
Care of battery in service

- Add nothing to the cells but distilled, deionised or approved water and do this often enough to keep the visible internal components covered at all times.
- The correct level for electrolyte after a charge is indicated by the float level indicator. Adding water should only be done AFTER a complete charge.

WHEN THE FLOAT
IS IN THE UPPER
MOST POSITION
THE CELL IS
FULLY
TOPPED UP.



WHEN THE FLOAT
IS IN THE LOWER
POSITION THE
CELL REQUIRES
TOPPING UP.



- Never add acid to a battery. If spillage or dilution of the electrolyte occurs, contact your Exide technician for assistance.
- Keep the top of the battery tray and containers dry and clean to prevent electrical leakage to earth.

....Adding water before charging may result in spilt electrolyte.....

- If excessive corrosion or other deterioration becomes evident in any part of the battery, contact your Exide technician for assistance.
- Regularly check the bolted connections on the battery for tightness and corrosion. Keep all connections smeared with petroleum jelly.
- Regularly inspect cable insulation and charging connectors for wear and contact your Exide technician to carry out repairs.

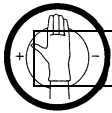
.....A dirty battery will lose power through tracking to earth

- Ensure all insulating shrouds on the cell connectors remain in position.
- Keep vent caps in place at all times during use and during charging. Electrolyte mist will escape during charging if the caps are removed resulting in acid loss and water loss through evaporation.

Care of battery out of service:

- If a battery is taken out of service for an extended period, or if a new battery is not put into service immediately, it should be charged and stored in a cool dry place.
- Charge monthly and check electrolyte levels.

.....leaving a battery in a discharged state will cause a build up of sulphate.
This chemical reaction will severely impede the electro-chemical process in
the battery and reduce output capacity.....



Maintenance

SUGGESTED MAINTENANCE SCHEDULE			
Action	1 monthly	3 monthly	12 monthly
Check for leaking cells	X		
Check intercell connections	X		
Top up cells with low electrolyte	X		
Check overall battery voltage	X		
Check cell voltage on float charge		X	
Check pilot cells for electrolyte density	X		
Check electrolyte density of all cells		X	
Test alarms, check charger voltmeter			X
Check electrolyte temperatures	X		

Water for use in battery cells

Pure water can take the form of distilled, deionised water. The standard of purity required for water is given in the Australian Standard AS2668 which specifies the following maximum impurity levels amongst other requirements.

Impurity	Max concentration parts per million	
Iron	as FE	5
Chloride	as C1	20
Manganese	as Mn	0.1
Copper	as Cu	5
Ammoniacal Nitrogen	as NH3	10
Nitrogen Oxides	as N	3
Total fixed residue (as sulphated ash)		150
Volatile fatty acids (VTA)		30

.....impure water will reduce battery life....



Battery Recycling

- Lead acid batteries contain lead and sulphuric acid. Each of these components can be dangerous unless properly disposed of. Exide offers you an easy and responsible way to prevent damage to the environment by taking back your old lead acid battery and recycling it. Currently, over 95% of the components in an Energystore battery can be recovered and recycled.
- Exide's recycling program, which we call "TOTAL BATTERY MANAGEMENT", ensures that your battery is fully and properly recycled.

Exide recycling:

- A better use of the worlds resources.
- A safe way to dispose of the problem
- A legal way to discharge your waste responsibilities.

To use our services just call your Exide sales or service representative.

.....battery recycling. Part of the total package!

Exide Technologies - Energystore Warranty

Energystore Warranty

Free of charge period:

In the unlikely event of the battery becoming unserviceable at any time within the first 12 months of installation, it will be exchanged or repaired, at the option of Exide, free of charge.

Pro rata warranty period

Should the battery become unserviceable at any time after the expiry of the free of charge period and before the expiry of a further 48 months, it will be exchanged or repaired, at the option of Exide on a pro rata basis. The replacement cost shall be calculated at the price of a new battery or the cost of repairs at the current list price less an allowance proportional to the unexpired period of the combined 5-year warranty.

Limitations on the Guarantee and Warranty:

In no event shall Exide Technologies be liable for consequential or incidental losses or damages. Exide further disclaims all implied warranties or merchantability and fitness.

Condition for General Warranty

1. The battery is considered to be unserviceable if its discharge capacity is less than 80% of its published capacity at a specified rate of discharge.
2. Exide Technologies or its agent must be notified of any warranty claim within 14 days and be allowed reasonable opportunity to inspect the installation.
3. Warranty claims will only be recognised if the cells or batteries are returned freight prepaid to Exide Technologies.
4. Cells held in storage must be recharged every 3 months.
5. Following a discharge the battery must be recharged within 24 hours.
6. Water used to top up cells must be battery grade deionised water complying with Australian Standard AS2668.
7. Charging and control equipment must be so arranged that the battery is not overcharged or discharged.
8. Temperature can greatly reduce battery life. For every 10°C increase in temperature over 25°C the life expectancy is reduced by 50%.
9. Exide Technologies reserve the right to perform any tests in the event of warranty claims.
10. Battery must be maintained as per this manual and records made available to Exide Technologies.

Maintenance Log

Owners Name: _____ Date: _____
 Address: _____ No. of Cells: _____

 State: _____ Post Code: _____
 Types: _____ Date New: _____ Date Installed: _____
 Charger Output: _____ Battery Temp°C : _____
 Total Battery Voltage: _____

Cell No	Volts	SG'S	Cell No.	Volts	SG's
1			13		
2			14		
3			15		
4			16		
5			17		
6			18		
7			19		
8			20		
9			21		
10			22		
11			23		
12			24		

Comments:

Readings taken by: _____

This Format may be copied as required.

Maintenance

EQUIPMENT REQUIRED

- | | |
|----------------------------|-------------------|
| Ψ Hydrometer-Syringe type | Ψ Distilled Water |
| Ψ Immersion Thermometer °C | Ψ Safety Glasses |
| Ψ Maintenance Log Book | Ψ D.C. Voltmeter |
| Ψ Emergency Eyewash Bottle | Ψ Rubber Gloves |

DON'T!

- Smoke in or near the battery room.
- Wear hand jewellery or a wristwatch whilst working on the battery.
- Disconnect any nuts or bolts on the system if the battery has recently gassed.
- Work on the battery with the vent plugs removed.
- Use contaminated water to top up the cells.
- Turn off any battery room ventilation for extended periods.

DO!

- Inspect, maintain and record on a regular schedule.
- Keep the battery clean.
- Wear safety equipment whilst working on the system
- Keep eye wash bottle full and conveniently located.
- Read all instructional information supplied with the system.

Fig 2. Fully charged voltage VS Charge Rate For Energystore

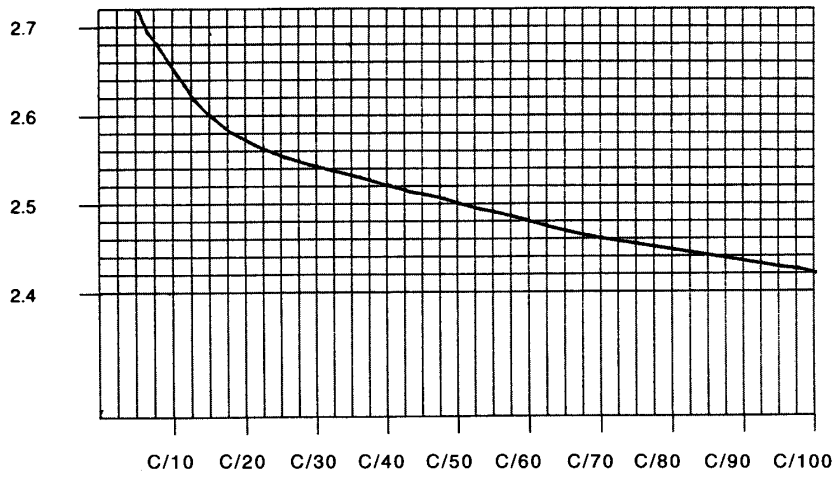


Fig 1. Recharge Voltage VS State Of Charge For Various Charge Rates For Energystore

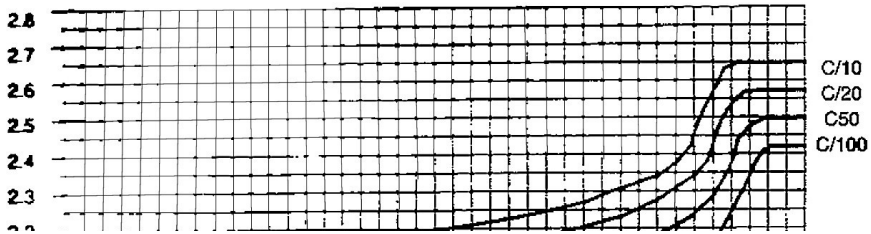


Fig 3. Curves Showing Voltage On Discharge of Energystore Range Batteries At Various Rates

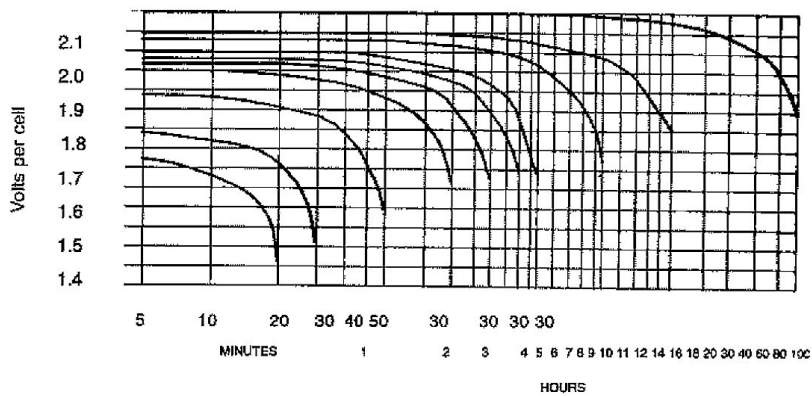


Fig 4. Open Circuit Voltage VS Discharge Depth for Energystore

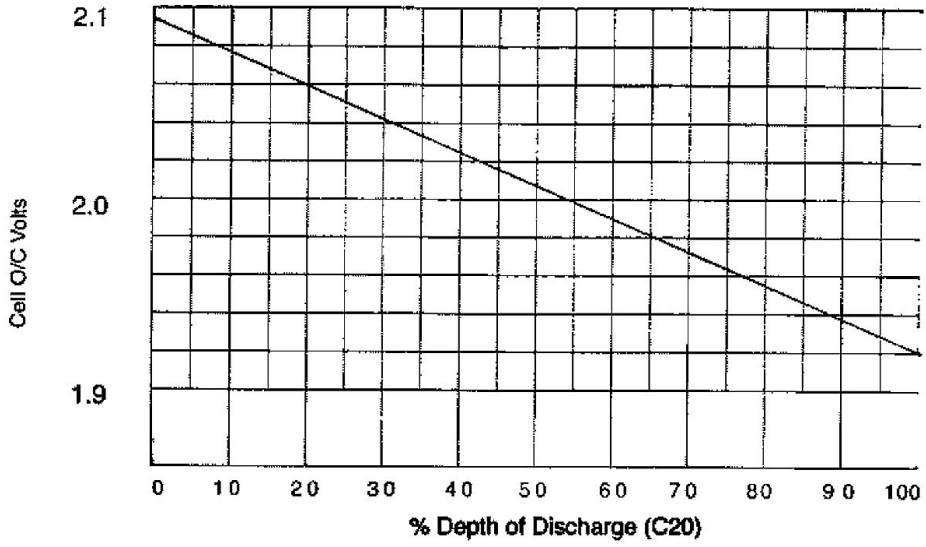
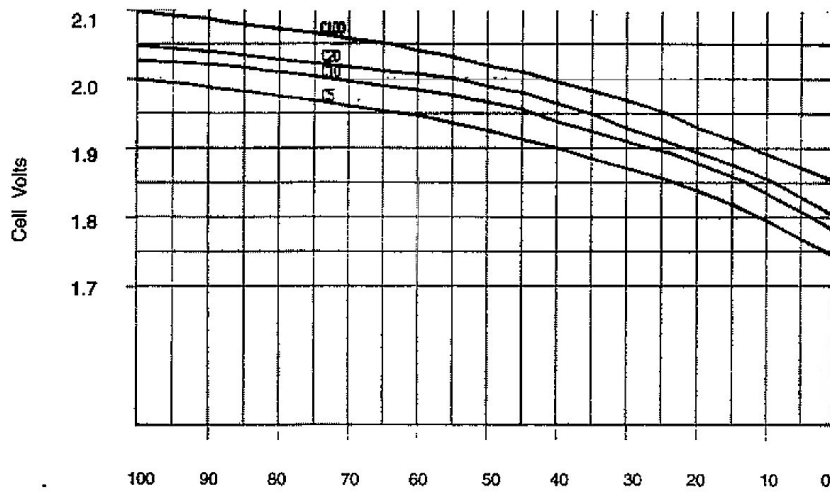
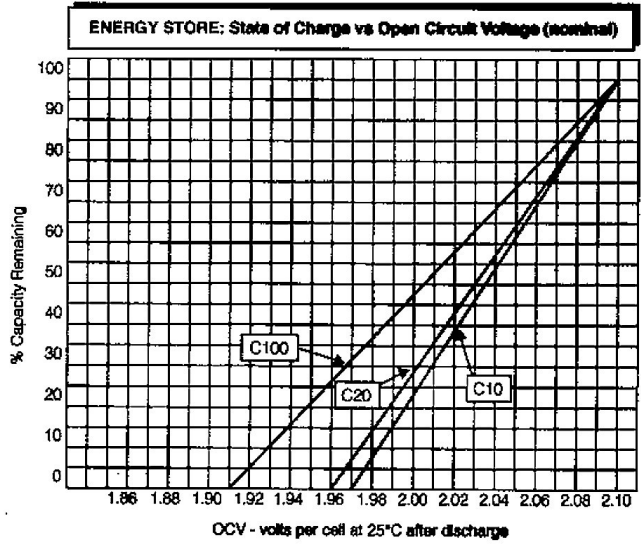


Fig 5. C100 VS Electrolyte Density

Fig 6. Cell Voltage VS Percent Charged @ Various Discharge Rates for Energystore



ENERGY STORE: State of Charge vs Electrolyte Density (nominal)



Energystore Tubular Cell Range Technical specifications

Cat No.	Volts	Amp Hour Capacities at 25C					Short Circuit (fault) current AMPS	Wt Kgs	Individual Tray Dimensions			
		C120 to 1.80vpc	C100 to 1.85vpc	C20 TO 1.85vpc	C10 TO 1.70vpc	C5 to 1.70vpc			No.of Trays per battery	Length Mm	Width Mm	Height mm
12RP340	12	375	340	213	190	171	1450	84	1	528	212	570
6RP570	6	625	570	356	316	285	2420	67	1	528	212	570
6RP670	6	735	670	423	376	339	2880	80	1	528	212	570
6RP750	6	825	750	493	438	395	3355	92	1	528	212	570
6RP830	6	910	830	565	501	452	3840	110	1	528	212	570
6RP910	6	1000	910	630	559	504	4280	116	1	528	260	570
6RP1080	6	1180	1080	772	685	618	5250	143	1	528	260	570
4RP1330	4	1460	1330	950	840	760	6620	120	1	370	308	630
4RP1600	4	1700	1600	1100	960	850	6620	140	1	370	308	630

Optional lids for each battery available. Part numbers of lids

Lid 1 – suitable for 12RP340, 6RP570, 6RP670, 6RP750, 6RP830 : 748309

Lid 2 – suitable for 6RP910, 6RP1080 : 748308

Lid 3 – suitable for 4RP1330, 4RP1600

TABLE 1