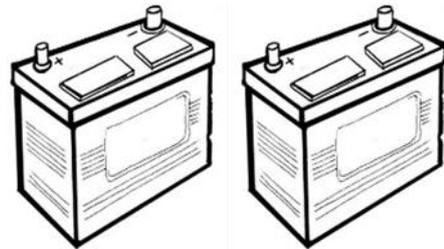


BATTERIES AND CHARGING

December 2016

How to care for your batteries



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Initial care

- Ensure the batteries are fully charged before the first use
- During the first 5 cycles, avoid excessive loads (e.g. steep slopes and beaches) and deep discharges
- Fully charge the chair, the charger light will turn green

New batteries take longer to achieve full charge and the capacity is reduced; this will improve

Recommendations

- Avoid allowing the batteries to get very flat
- Charge as soon as possible after flattening
- Always fully recharge the batteries (this may take more than 8 hours)

To get the maximum range from your batteries

- Ensure that the tyre pressures are correct for the weight and the terrain
- Avoid stop-go driving; try to maintain a constant speed
- Try to avoid inclines
- Limit baggage weight carried

PLEASE NOTE: The charger may not operate if the batteries have been allowed to go completely flat. If this happens, call your Magic Mobility Dealer for assistance.

Batteries

Your power chair uses a pair of high quality, long lasting gel cell batteries that are sealed and maintenance free. Your power chair has a 24V system which is supplied by two 12V batteries. There is no need to check the electrolyte fluid level they contain. Despite their similarity to automotive batteries, they are not the same. Automotive batteries are not designed to handle a long, deep discharge, and are also unsafe for use in power chairs.



WARNING! Battery posts, terminals, and related accessories contain lead and lead compounds, wash your hands after touching.

WARNING! Corrosive chemicals are contained in the batteries. Use only AGM or gel-cell batteries to reduce the risk of leakage or explosive conditions.

WARNING! When fitting alternate batteries, ensure their terminal posts cannot touch any part of the wheelchair frame



STOP! Automotive batteries and chargers are unsafe for use in power wheelchairs

Battery charging

We recommend using only a high quality **intelligent** battery charger that is compatible with your power chair's batteries. Only use the supplied off-board charger unless otherwise approved by Magic Mobility. Do not use an automotive-type battery charge.

The charger will not operate after the batteries have been discharged to an extremely low voltage. If this happens, call your Magic Mobility Dealer for assistance.

Battery run-in

Proper care of the battery during the 'run in' (initial care) period is particularly important for battery life.

PROCEDURE

- Ensure the Battery is fully charged before the first use,
- Use the chair normally during the day, avoid excessive loads during the first 5 cycles,
- Charge the chair fully overnight, checking that the charger indicates that the battery is fully charged (enters float mode),
- Repeat steps 2 and 3 for the first 20 times (cycles) to complete the 'Run in' procedure.

PLEASE NOTE: The new battery will take longer to achieve the full charge, but the time required will improve. Initially you may find that you have to limit the amount of use during the day for the full charge to be achieved.

The battery capacity is reduced when new, this is normal and will improve during the run-in process.

Charging procedure

Battery Charging is via a socket within the joystick module. When a charger is plugged in, the joystick unit recognises the unit is plugged in and chair driving is inhibited.

The following procedure is valid for the recommended charger brand - consult your separate charger instructions if supplied with an alternative charger:

1. Ensure the wheelchair is turned off
2. Always make sure that the charger is turned off before plugging it into the wheelchair
3. Plug the charger into the charging socket on the joystick module
4. Please consult the instruction manual supplied with your charger for detailed instructions

The following advice is recommended to help care for your batteries:

- Avoid ultra-deep discharges (deep discharges reduce cycle life)
- Don't leave batteries at a low state of charge for an extended period of time (e.g. after a day's use fully recharge the batteries overnight)
- After discharging the batteries to a low state of charge, recharge them fully (this may take more than 8 hours)

	<p>WARNING! Always protect the batteries from freezing and never charge a frozen battery. Doing so can result in personal injury and damage to the battery.</p>
	<p>STOP! Do not put the charger on the seat of the wheelchair when charging as the charger can become quite warm. Always put the charger on the floor near the chair when in use.</p>

To get the maximum range from your batteries:

- Fully charge the batteries prior to the trip
- Ensure that the tyre pressures are correct for the weight and the terrain
- Avoid stop-go driving; try to maintain a constant speed
- Try to avoid inclines
- Limit baggage weight carried

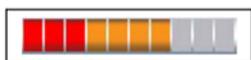
Do not operate the control system if the battery is nearly discharged. Failure to comply with this condition may leave the user stranded in an unsafe position, such as in the middle of a road. Magic Mobility accepts no liability for losses of any kind arising from failure to comply with this condition.

Battery gauge

LCD screen Battery Gauge:



The batteries are charged if the battery gauge shows red, yellow and green



You should charge the batteries as soon as you can if the battery gauge shows just red and yellow



You should charge the batteries immediately if the battery gauge shows just red, either steady or flashing slowly

LED battery gauge



Battery Gauge

- | | |
|---------------|---|
| (LEDs 1 - 10) | The batteries are charged if the battery gauge shows red, yellow and green. |
| (LEDs 1 - 7) | You should charge the batteries as soon as you can if the battery gauge shows just red and yellow |
| (LEDs 1 - 3) | You should charge the batteries immediately if the battery gauge shows just red, either steady or flashing slowly |

Your battery gauge may also flash in different patterns to indicate your battery's status:

- LEDs on, Steady: This indicates that all is well and displays your level of remaining charge
- LEDs Flashing Slowly: The control system is functioning correctly but needs charging
- LEDs Light up sequentially, Stepping Up: The wheelchair batteries are being charged. You will not be able to drive the wheelchair until the charger is disconnected and you have switched the control system off and on again

HOW YOUR BATTERY GAUGE WORKS:

The battery gauge lets you know how much charge is left in your batteries. The best way for you to use the gauge is to learn how it behaves as you drive the wheelchair. Like the fuel gauge in a car, it is not completely accurate, but it will help you avoid running out of "fuel".

When you switch on the control system, the battery gauge shows an estimate of the remaining battery charge. The battery gauge gives you a more accurate reading about a minute after you start driving the wheelchair.

The amount of charge in your batteries depends on the way you use your wheelchair, the temperature of the batteries and their age. These factors will affect the distance you can travel in your wheelchair. All wheelchair batteries will gradually lose their capacity as they age.

If your battery gauge reading seems to fall more quickly than usual, your batteries may be worn out. When you replace worn out batteries, fit the type recommended by Magic Mobility. If you use another type, the battery gauge may be inaccurate.

Public transportation

The Gel Cell batteries are Federal Aviation Administration (FAA) approved, allowing safe transportation on aircraft, buses and trains. However, Magic Mobility recommends that any specific requirements of the carrier are checked in advance. When flying with your wheelchair, please call the airline for any specific information they need. Magic Mobility has a "flying with your wheelchair" fact sheet on the website that covers most questions.

Battery disposal and recycling

If you encounter a damaged or cracked battery, contact your Magic Mobility Dealer for instructions on disposal. Your Magic Mobility Dealer will also have all the necessary information on the recycling of batteries as well as all other wheelchair parts, which is our recommended course of action.

Gel battery performance and range

The performance of the batteries is affected by many things – it is difficult to give precise range forecasts.

With the X8 and the Frontier All Terrain, a very easy way to improve the range is to pump up the tyres. However, if you go on the beach or in mud the X8 will perform much better if the tyres are at low pressure. This kind of activity will make the batteries drain very quickly as the motors are working very hard all the time.

If you are using the X8 or the Frontier All Terrain on trails or even on the street where the surface is quite firm, then it is possible to put more air in the tyres. We recommend up to 8psi, but you could maybe go a little bit more.

With the X8 and the Frontier All Terrain, Magic investigated installing bigger batteries, but we felt that it was important to maintain the overall size of the chair. So we chose to stay with the 73Ahr. Not only are the bigger batteries much more expensive they add an enormous amount of weight and negate their own higher amperage to some degree!

Our electrical engineer reviews the battery market regularly to see if anyone has produced a bigger battery that will fit in the X8. We also prefer to use Geltech or Sonnenschein batteries. Our experience to date tells us that they are still a superior battery.

Unfortunately, the nature of the lead acid gel battery means that they will deteriorate with every cycle. There isn't much you can do apart from charging them up every night and trying not to let them get too flat too often.

Batteries are a big investment, and for someone who uses their chair every day, we recommend budgeting to replace them every 18 months – they might last a bit longer and if they do, that is great!

Follow the tips in the owner's manual to maximise your batteries:

- Follow the run-in procedure
- Follow the charging procedure
- Your charger is critical, see the information below
- Charge the batteries at room temperature
- Charge them as soon as possible after a deep discharge
- Be temperature aware – batteries don't like being hot or cold – if you are enjoying afternoon cocktails, try to get you chair in the shade of the table if you can

Further factors effecting battery energy available

Questions to be asked if battery life is not meeting expectations

- Are the batteries brand new?
 - If so, be aware that the batteries are 'lazy' to begin with and take 5-10 cycles before good performance is achieved.
- Have the batteries been looked after since new and all procedures been followed?
- Has the recommendation to avoid over discharge been followed?
- Have the batteries been charged as soon as possible following when large discharges?
- Has the recommendation to fully recharge the batteries after discharge been followed?
- Have the batteries only been charged with the correct charger? (see below)
- Have the batteries only been charged at moderate temperatures?
 - The charging voltage/ profile for the charger is designed for charging a battery that is at room temperature. For maximum battery life and to enable the battery to be charged fully always charge with the battery at or close to room temperature (batteries have a high thermal mass and are slow to change temperature)
- Are the Batteries Balanced (do they have similar voltage)?
 - Connecting any devices (e.g. a 12V device) across one battery is strictly forbidden as it will affect the balancing resulting in incorrect charging voltages at the individual battery
- Have the Batteries been protected from excessive temperatures?
 - Avoiding leaving the chair in the sun in hot weather, etc.? Avoid temperatures below -20C and above 60C
- Are the Connections and Battery Cable Circuits in good condition so that the resistance is low?
 - Excessive resistance could affect charging, the speed of the Wheelchair, the Efficiency of operation and may cause the Wheelchairs Electronics to indicate that the Battery is further discharged than what it actually is
- Are there other devices consuming power from the wheelchair batteries?
- Is the weight on the chair minimised by avoiding carrying excess baggage?
- Are the tyres and tyre pressures appropriate for the terrain and gross weight of the wheelchair?
 - See the owner's manual for more information
- Does the Wheelchair roll freely without excessive drag?
 - Check by switching of the controller and disengaging motors, it should be able to be pushed without an excessive amount of effort on a firm flat surface, try straight ahead and also turning to the left and right

Factors that significantly affect the life of a battery

CYCLIC LIFE

The battery life is mainly determined by the use cycles of the battery. An AGM or flooded battery may have a life of 300 to 700 cycles under normal use; however, that of a gel battery may be from 500 to 5000 cycles. The battery completes a cycle when it is charged and discharges once. In a solar system, the batteries are

charged during the day and they are partially discharged during the night. In this case, one cycle corresponds to one day.

DEPTH OF DISCHARGE (DOD) EFFECT

The harder the battery works, the sooner it will fail. This means that a higher capacity withdrawal would result in a reduction of life cycle. Here is a table that explains the effect of depth of discharge.

Typical VRLA Battery Cycling Ability vs Depth of Discharge		
	Typical Life Cycles	
Capacity Withdrawn	Gel Battery	AGM or Flooded Battery
100%	450	200
80%	600	250
50%	1000	500
25%	2100	1200
10%	5700	3200

Temperature effect

Temperature is a major factor in battery performance, shelf life, charging and voltage control. At higher temperatures there is dramatically more chemical activity inside a battery than at lower temperatures. Therefore, the capacity of a battery is lower when the ambient temperature is too low. (eg. A battery bank that is kept outdoor in winter).

For most of the batteries, 65-90 F is the recommended temperature range. In higher temperatures, the battery cyclic life would significantly reduce. We can conclude that, cold temperature is not good for the performance of the battery; warmer temperature is not good for the battery life.

Recharge voltage and rate

All lead-acid batteries give off hydrogen from the negative plate and oxygen from the positive plate during charging. The valve regulated batteries (VRLA) have pressure sensitive valves. Without the ability to retain pressure within the cells, hydrogen and oxygen would be lost to the atmosphere, eventually drying out the electrolyte and separators.

A battery can only store a certain quantity of electricity. The closer it gets to being fully charged, the slower it must be charged.

Typically, the battery would be charged up to 90% in 60% of the overall charging time; the remaining 10% would take up to 40% the total time. Therefore, it is critical to use a suitable charge controller in order to regulate the voltage and the charge rate when charging a battery.

Any VRLA battery will dry out and fail prematurely if it experiences excessive overcharge.

It should be noted that, 13.8-14.1 V voltage range would mean a fully charged battery for a Gel type battery whereas, 14.4- 14.6V voltage range would mean a fully charged AGM battery.

A totally discharged battery is at 11.8-12.0 Volts.

Power consumption on batteries

The Battery Charger that we use in an efficient Switch Mode Regulated device, which is effective at reducing the power consumption when the Battery in the wheelchair has reached its charged capacity.

There is very little electricity cost saving to be had by not leaving the wheelchair plugged in. You could leave a battery on the charger for a year for \$18.60, and at the end of it you would still have a fully charged (and healthy) battery. This is a cost of 0.2 cents/hour based on 25cents/ KWH.

- 4.5 Watts with no batteries connected
- 8.5 Watts when connected to batteries and in float mode

Based on \$0.25 per kw/h, the annual cost would be around \$18 if left on and the charger was in float mode 24/7.

Battery chargers

ATTENTION, NOT ALL BATTERY CHARGERS ARE CREATED EQUAL

If you need to purchase a charger other than the one that Magic supplies with the chair, you need to check the following characteristics to ensure that the charger is appropriate for the Geltech Batteries;

Does that charger have a sufficient charging rate to re-charge the battery in a timely manner?

- The charger must have a current rate of at least 10% of the 20hour capacity:
 - The 73AH battery needs a charger of 7.3A or greater. Note, the wheelchair charging circuits are limited to a maximum continuous charging current of 12A
 - The 40AH battery needs a charger of 4.0A or greater. Note, the wheelchair charging circuits are limited to a maximum continuous charging current of 8A
- Does the charger have a Boost/ Absorption charge voltage of 27.6 - 28.2V?
- Does the charger have a float voltage of 27 - 27.6V?

Please note there can be differences in the recommended charging voltage for other brands of Batteries.

Also note that the charging voltages are appropriate for temperatures close to 25degC. For maximum battery life avoid charging the chair in locations in which temperature extremes are present (e.g. charging the chair in a tin shed compared to charging the chair in a temperature controlled area in the house).

If you are in any doubt as to the suitability of your charger, please contact Magic Mobility for assistance

Using an incorrect charger can shorten the life of the battery and void your warranty.

Charger performance

The charger should be able to cope with batteries that have deteriorated.

The charger should go into float mode (drop to 27.4V) when the current drops below 0.3A.

If this is not occurring, then it would either be a fault in the batteries or there is something else that is using the power.

Note that the charge procedure is to switch off the controller, and this also applies to any other accessories that are powered from the chairs

Leaving anything switched on which uses some of the current provided by the charger will delay or prevent the charger from going into float mode, and this can lead to damage to the batteries by overcharging.

Will my charger work in the USA?

Your wheelchair requires a 24Volt 8Amp Charger.

	<p>The charger only operates on 240V so it won't work on a USA 110V power point even if you do have an adapter. To make it work you will need a 'step up transformer' such as the one in the attached image that converts the 110V power point to 240V, and it will need a capacity of at least 400W</p> <p>http://www.tortech.com.au/category/american-step-up-transformer-110vac-to-240vac-operate-australian-equipment-in-america</p>
	<p>Otherwise you would have to buy a wheelchair charger that runs on 110V, Soneil make a charger that will work on 110 or 240 - it is the Zeta-40 2416SR. You will need to bring it into Magic or have someone fit the correct plug for your joystick</p> <p>http://soneil.com/product/model-2416sr/</p>

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