Li-ion Battery System for Solar Racing Cars

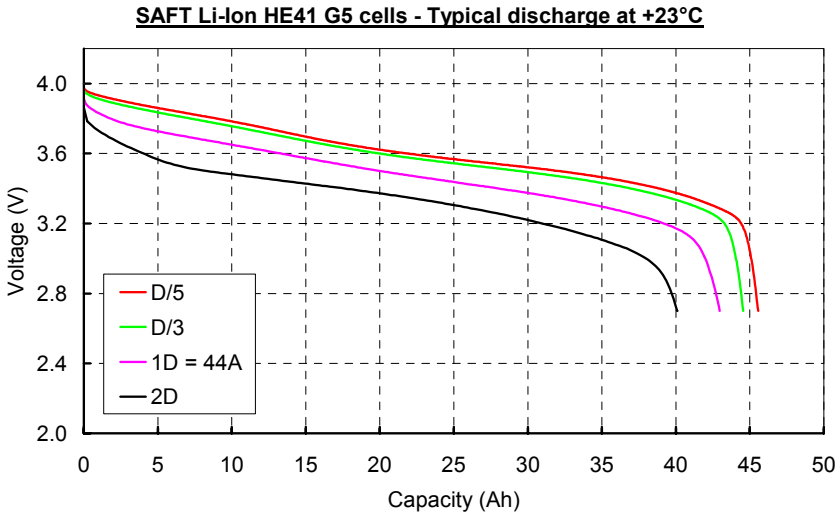
Solion is pleased to announce that SAFT Li-ion batteries are now available to solar racing car teams. The SAFT HE41 cell is a superior technology Li-ion battery made to the highest standards. The cell has a mass of 1.05kg and a minimum capacity of 41Ah at C/3 discharge. A single string of 28 HE41 cells has a mass of 29.4kg (ASC rules), nominal voltage of 100.8V and minimum 4.13kWh at C/3 rate (147Wh/kg). With a specific power of 420W/kg the battery system can produce over 12kW (120A) continuously. Solion has measured the charge/discharge efficiency of the battery cell at 99%.

Solion's Li-ion battery system enables teams to have the best batteries and a tried and tested safety system. Li-ion batteries MUST be controlled to ensure they operate within strict limits. Solion will supply teams with a battery pack and safety system. The safety system monitors the voltage and temperature of each cell, if set limits are exceeded the battery pack is disconnected by a relay. A fast acting fuse protects from short circuit or over current. The battery system is designed to meet ASC2003 and WSC2003 regulations.

SAFT HE41	DATA
Nominal voltage (V)	3.6
Capacity C/3 rate (Ah)	41
Specific energy (Wh/kg)	147
Energy Density (Wh/dm^3)	290
Specific power (W/kg)	420
Power density (W/dm^3)	880
Vmax (V)	4.00
Vmin (V)	2.55
Diameter (mm)	54
Height max (mm)	220
Weight (kg)	1.05
Volume (dm^3)	0.5

SAFT HE41 Li-ion Battery

Many manufacturers only supply the C/20 rate (20 hours discharge) for their batteries giving energy densities of 180-200Wh/kg, these figures are unrealistic for solar cars. When choosing the batteries for your car, remember not to be fooled by high energy density claims, as the discharge rate increases, capacity decreases. The discharge characteristics of the SAFT HE41 cell is shown below and the capacity variance at different discharge rates can be seen.



Features of the Solion Li-ion Battery System

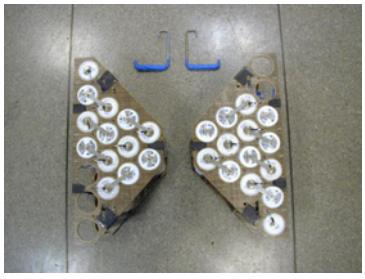
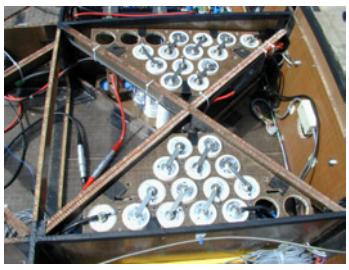
Over and under voltage battery protection – The voltage of each cell is measured and the upper and lower limits set to 4.00V and 2.55V. If the voltages of any cells are exceeded, a relay disconnects the batteries. A reset switch, operated by the solar car driver is provided to reconnect the battery pack. When charging from solar, the battery disconnects when any cell reaches 4.00V. Within a few seconds, the batteries naturally 'settle' back to about 3.98V and the battery pack can be re-connected. A back-up safety system measures the voltage of the complete battery system and if an overall battery voltage is exceeded 'blows' a switch. The 'blown' switches are easily replaced when the battery voltage is back within the correct limits.

Over temperature switch – A temperature switch is attached to each battery cell and disconnects the battery pack with the relay when any cell exceeds 60C. The battery pack is re-connected by the reset switch, operated by the driver.

Over current protection - A fuse protects the system from short circuits. The current output from the batteries can be 120A continuously and up to 300A for a few seconds. In solar cars these currents will only be seen if there is a short circuit and therefore a fuse is adequate protection against over current.

The Li-ion system comprises:

- Complete set of pre-wired SAFT HE41 batteries including spares/test cells.
- Battery safety management electronics. All the electronics are supplied in one lightweight box. The system is simple and modular so that circuit board can be easily replaced in the unlikely event of any failures.
- Battery enclosure can be made from Fibrelam. The picture below shows how the custom battery pack for Mad Dog 3 was made to fit between the cross pieces of the chassis stiffeners.

- Wired and connected with top grade nickel plated copper strips and LEMO connectors.
- Adaptable for both the ASC and WSC regulations. Extra batteries and fixing holes can be included so that the solar car can be raced at the World's major events. The nominal battery voltage for the ASC is 100.8V (28 cells) and for the WSC 122.4V (34 cells).
- Full set of manuals, instructions and help. Solion engineers will also be at the 2003 ASC and WSC assisting teams.

The Solion Li-ion battery system is a technological leap for solar cars. Any team that wants to know more about the benefits of the system and how to obtain one should contact Dr Mike Duke at Solion Ltd.

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