



SAFT

Anatomy of Battery Assembly

Glen Bowling, VP Saft

Subject to following UN Tests

T1 – Altitude T3 – Vibration T5 – Short Circuit
T2 – Thermal T4 – Shock T6 – Impact T8 – Forced Discharge

The Cell

- The basic electrochemical unit with the electrochemical voltage of the couple
 - ~3.5 to 4.5 volts
- Contiguous electrolyte pool
- A positive and negative terminal
- Normally no electronics (except as a single cell battery)

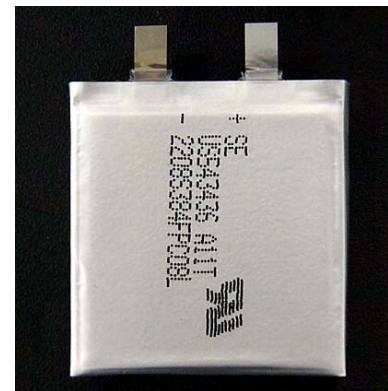
Cylindrical



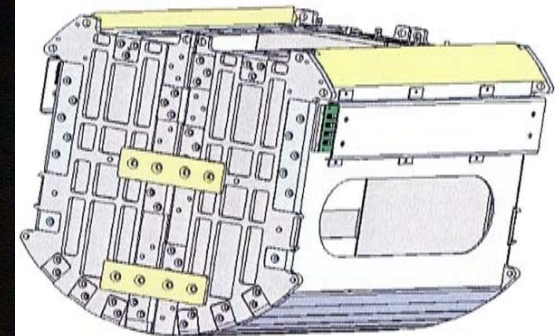
Prismatic



Pouch



Custom Shapes



Courtesy of Yardney Technical Products, Inc.

Subject to following UN Tests

T1 – Altitude T3 – Vibration T5 – Short Circuit
T2 – Thermal T4 – Shock T7 – Overcharge

Battery (Module)

- **Group of cells that are electrically and physically connected together in a manner appropriate for the application and environment**
- **Electronics for balancing, monitoring and signaling**
- **May not have complete electronics (i.e. fuses, diodes or circuit breaker) at this level due to reliability needs or power levels**
- **Must be professionally installed into a battery assembly to function as designed**

Modules!



Module!



NOT a Module! Just Cells in Cell Holder



Subject to following UN Tests (if ≤ 6200 Wh)
(T3 – Vibration T4 – Shock T5 – Short Circuit T7 – Overcharge)

Li-ion Battery & Battery Assemblies

- An electrically and physically connected group of cells (battery) or modules (battery assembly) with a complete electronics, physical packaging appropriate for the application and the communications and power connections which mate with the device it will power.
- Has all safety devices functional at the terminals of the battery
 - Overcharge (redundant protection absolutely essential)
 - Over current (fuses or switches)
 - Over temp (may have cooling system or current limiter)
 - Physical protections for vib/shock/drop/moisture/heat/etc.
 - Vents or other over-pressure safety devices
- Can be any combination of series and parallel as long as they are all within the same control system's purview



Li-ion Battery & Battery Assemblies

- To add to the confusion:
 - One cell with safety devices and connections and enclosure is a battery
 - Multiple batteries or battery assemblies may be able to be connected in series or parallel reliably in an application
 - Depends on the electronics
 - If they can, then next level is a Battery Assembly
 - Impossible to test some of these due to size
 - Battery Assemblies may be spread in multiple physical locations
 - Vehicle battery assemblies in several smaller compartments
 - Submarine battery assemblies in multiple tubes or boxes



Small
VL or
MP with
Circuit
and
wires

