Design Considerations for High Energy Density Large Format Lithium–Ion

2nd Israeli Power Sources
May 2012
Epsilor is part of the Power Sources Division of Arotech Corporation (Nasdaq: ARTX)
<table>
<thead>
<tr>
<th>Service</th>
<th>Image</th>
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<tbody>
<tr>
<td>Battery Pack Design</td>
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<td>Battery Pack Electronics</td>
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<td>Primary &amp; Rechargeable</td>
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<td>Chargers</td>
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<td>Manufacturing</td>
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<td>Testing Services</td>
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**One-Stop-Shop for Custom Power**

From Concept To Field

**epsilor**

**THE SOURCE FOR POWER**
Epsilor serves the following Market Sectors:

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<tr>
<th>Sector</th>
<th>Image</th>
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<td>Military</td>
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<td>Industrial</td>
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<td>Aerospace</td>
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<td>Medical</td>
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<td>EV</td>
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<td>Testing Services</td>
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Epsilor has two facilities in Israel:

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<td><strong>Engineering</strong></td>
<td><strong>Electrochemistry</strong></td>
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<td><strong>Production</strong></td>
<td><strong>Testing (UN)</strong></td>
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<td><strong>Marketing</strong></td>
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High Profile Projects
Epsilor’s Large Format Battery Design

- High energy & high energy density
- Based on small format li-ion cells with demonstrated reliability and uniform performance
- Proprietary balancing
- 4 layer BMS
- High thermal dissipation packaging
Specification of Large Format building block

- Layout: 7SX13P(24x18650-MR2791 battery)
- Nominal Capacity: 190Ah
- Nominal Voltage: 102VDC
- Energy: 19.9KWh
- Cell Weight: 120kg
- Block Weight: 220kg
Actual discharge results
Battery has 4 layers
Battery Architecture

Matrix design
• Higher performance (better redundancy features)
Battery Architecture

Matrix design
• Higher performance (better redundancy features)
250KWh battery design based on the same architecture

Power Pack X 2

Module X 8

Sub Module X 8

Basic Module X 15
Cell Selection

High uniformity of cell characteristics is critical
Balancing method - Charger

The balancing is performed in the charger
9KW Charger
Thermal Dissipation

**Thermal Design**
- Incorporating heat conductors in the design. Heat generation is function of SOC.

**Thermal Uniformity**
- Silicone oil with favorable properties:
  - Low electrical conductivity
  - Low viscosity
  - Good heat conductivity
Thank you

www. epsilor .com