SIO OBS - Battery Systems
Presentation Overview

• Description of OBS system loads
• Breakdown of Electrochem battery packs used and cell specifications / related applications.
• Alkaline Packs used (Internal as well as external sourcing)
  • ‘D’ Cell pack used for active cruise short duration deployments
  • Acoustic Release Pack
  • Clock pack
• Flex cable design for series and parallel connections of packs
• Electrochem pack with integrated fuel gage monitor
## OBS System Electrical Loads

<table>
<thead>
<tr>
<th>Description</th>
<th>Voltage Supply Range</th>
<th>Current Draw</th>
<th>Nominal Power Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logger (@ 200 SPS)</td>
<td>7 – 16VDC</td>
<td>85mA - 37mA</td>
<td>592mW – 607mW</td>
</tr>
<tr>
<td>Sensor (Trillium 240)</td>
<td>~15VDC</td>
<td>~53mA</td>
<td>800mW (original)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>650mW (new version)</td>
</tr>
<tr>
<td>HTI-90-U Hydrophone</td>
<td>10VDC</td>
<td>4mA</td>
<td>40mW</td>
</tr>
<tr>
<td>DPG sensor</td>
<td>5VDC</td>
<td>1.25mA</td>
<td>6.25mW</td>
</tr>
</tbody>
</table>
CSC93 DD and BCX85 DD Cell Information

**HIGH RATE LITHIUM CELL**
**CSC93 SERIES: 3B0036**
**SIZE DD**

**LITHIUM SULFURYL CHLORIDE CELL**

**Technical Overview**

- **Open Circuit Voltage (35°C):** 3.8 V
- **Rated Discharge Current:** 1.0 A
- **Rated Capacity:** 30 Ah
- **Maximum Continuous Current:** 46 A
- **Cell Diameter:** 33.5 mm (1.32 in.)
- **Cell Length:** 111.4 mm (4.39 in.)
- **Cell Weight:** 219 g
- **Lithium Weight:** 102 g
- **Safety Fuse:** 7.6 A
- **Self Discharge:** 3% per year at 25°C
- **Operating Temperature:** -50°C to +50°C
- **Discharge:** -4°C to +200°F

**Key Features:**
- Primary chemistry (non-exchangeable)
- High rate capability
- Advanced spiral-wound technology
- Stainless steel containers
- Hermetic glass-to-metal sealing
- Wide operating temperature range: as low as -20°C and up to +50°C
- Low self-discharge rates (0.7% per year at 25°C)
- Restricted air transportation (Class 9)
- Custom terminations available

**Main Applications:**
- Military communications
- Oceanographic buoys and gliders
- Tactical systems
- Source systems
- Pipeline inspection gauges
- Sensors, transmitters and receivers
- Satellite surveying tools

**NOTICE:** The information on this sheet is for single cells only. Please consult with Electrochem if you are interested in additional information. The information in this document is subject to change without notice and does not constitute a warranty of performance.

**BCX85 has improved cold temp performance over CSC at or below -20°C.**

If the battery is discharged at 0°C or warmer and load per cell is low, both BCX or CSC could be used.

If load per cell is high then CSC will have better performance.

**HIGH RATE LITHIUM CELL**
**BCX85 SERIES: 3B0076**
**SIZE DD**

**LITHIUM BROMINE CHLORIDE CELL**

**Technical Overview**

- **Open Circuit Voltage (25°C):** 3.8 V
- **Rated Discharge Current:** 310 mA
- **Rated Capacity:** 30 Ah
- **Maximum Continuous Current:** 48 A
- **Cell Diameter:** 33.5 mm (1.32 in.)
- **Cell Length:** 111.5 mm (4.39 in.)
- **Cell Weight:** 216 g
- **Lithium Weight:** 102 g
- **Safety Fuse:** 6.0 A
- **Self Discharge:** 3% per year at 25°C
- **Operating Temperature:** -55°C to +85°C
- **Discharge:** -67°F to +185°F

**Key Features:**
- Primary chemistry (non-exchangeable)
- High rate capability
- Advanced spiral-wound technology
- Stainless steel containers
- Hermetic glass-to-metal sealing
- Wide operating temperature range: as low as -50°C and up to +85°C
- Low self-discharge rates (0.7% per year at 25°C)
- Restricted air transportation (Class 9)
- Custom terminations available

**Main Applications:**
- Military communications
- Oceanographic buoys and gliders
- Tactical systems
- Source systems
- Pipeline inspection gauges
- Sensors, transmitters and receivers
- Satellite surveying tools

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LITHIUM BROMINE CHLORIDE CELL

Key Features:
- Penunary chemistry (non-exchangeable)
- High rate capability
- Advanced small-round technology
- Smaller sized components
- Hermetic foil-to-metal welding
- Wide operating temperature range as low as -55°C and up to +85°C
- Low self-discharge rate (2% per year at 25°C)
- Restricted for transportation (Class 9)
- Custom terminations available

Main Applications:
- Military communications
- Geophysical surveying and geodesy
- Tracking systems
- Sensor systems
- Pipeline inspection gauges
- Barometric, transducers, and sensors
- Seismic surveying tools

25°C discharge

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Electrochem Lithium Primary Battery Pack
Examples

New Electronics Abalones Small Pressure Case

Clock Pack

4x4 LP or SP

Abalones Instrument Battery Bottle
# Electrochem Lithium Primary Battery Packs

<table>
<thead>
<tr>
<th>Application</th>
<th>Diagram</th>
<th>Cell Type</th>
<th>Nominal Cell Capacity (Ah)</th>
<th>Pack Cell Config</th>
<th>Nominal Pack Capacity per output (Ah)</th>
<th>Cell / Supply Count</th>
<th>Available Voltages Open Circuit</th>
<th>Protection Circuitry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clock Pack</td>
<td></td>
<td>BCX-C</td>
<td>7</td>
<td>1S-2P</td>
<td>14</td>
<td>2 / 1</td>
<td>3.7</td>
<td></td>
</tr>
<tr>
<td>Abalones LP w/new logger small housing</td>
<td></td>
<td>CSC-DD</td>
<td>30</td>
<td>1S,2S,4S</td>
<td>30</td>
<td>7 / 3</td>
<td>3.9, 7.8, 15.6</td>
<td></td>
</tr>
<tr>
<td>WHOI Modem</td>
<td></td>
<td>BCX-DD</td>
<td>30</td>
<td>6S-2P</td>
<td>60</td>
<td>12 / 1</td>
<td>23.28-23.64</td>
<td></td>
</tr>
<tr>
<td>Larger pressure case w/new logger or 4x4 OR 4x4 batt bottle</td>
<td></td>
<td>BCX-DD</td>
<td>30</td>
<td>4S-3P</td>
<td>90</td>
<td>12 / 1</td>
<td>15.0-15.7</td>
<td></td>
</tr>
<tr>
<td>Fuel Gauge FLIP (low profile SP) OR Abalones LP</td>
<td></td>
<td>CSC-DD</td>
<td>30</td>
<td>4S-7P</td>
<td>210</td>
<td>28 / 1</td>
<td>15.6</td>
<td></td>
</tr>
<tr>
<td>L-Cheap Logger Legacy</td>
<td></td>
<td>BCX-DD</td>
<td>30</td>
<td>2S,2S 4S-2P</td>
<td>90</td>
<td>12 / 3</td>
<td>+/-7.4-7.9, 14.8-15.8</td>
<td></td>
</tr>
<tr>
<td>4x4 Logger Larger Pressure Case</td>
<td></td>
<td>BCX-DD</td>
<td>30</td>
<td>2S, 6P</td>
<td>180</td>
<td>12 / 1</td>
<td>7.4-7.9</td>
<td></td>
</tr>
<tr>
<td>Abalones Instrument Battery Bottle</td>
<td></td>
<td>CSC-DD</td>
<td>30</td>
<td>4S, 7P</td>
<td>210</td>
<td>28 / 1</td>
<td>15.6</td>
<td></td>
</tr>
</tbody>
</table>

- **Green** circle: Each cell has 4A series fuse w/ parallel diode
- **Orange** circle: Each cell has 4A series fuse w/ parallel diode, plus diode in series
- **Purple** circle: Blocking diode at the top of each series string of cells

Each cell has 4A series fuse w/ parallel diode.
Protection Diode Spec

1N5817 - 1N5819
1.0A SCHOTTKY BARRIER RECTIFIER

Features
- Guard Ring Die Construction for Transient Protection
- Low Power Loss, High Efficiency
- High Surge Capability
- High Current Capability and Low Forward Voltage Drop
- Suitable for Low Voltage, High Frequency Inverters, Free Wheeling, and Polarity Protection Applications
- Lead Free Finish, RoHS Compliant (Note 5)

Mechanical Data
- Case: DO41
- Case Material: Molded Plastic, UL Flammability Classification: 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020C
- Terminals: Terminals Plated Leads Substantially per MIL-STD-202, Method 208B
- Polarity: Cathode Band
- Ordering Information: See Page 2
- Marking: Type Number and Date Code
- Weight: 0.3 grams (approximate)

Maximum Ratings and Electrical Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Symbol</th>
<th>1N5817</th>
<th>1N5819</th>
<th>1N5819</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Inverse Recovered Voltage (Note 3)</td>
<td>Vrms</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>V</td>
</tr>
<tr>
<td>Average Diode Clamping Voltage (Note 4)</td>
<td>Vcl</td>
<td>6.5</td>
<td>6.5</td>
<td>6.5</td>
<td>V</td>
</tr>
<tr>
<td>Average Rated Diode Clamping Voltage (Note 5)</td>
<td>Vcl</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>A</td>
</tr>
<tr>
<td>Non-Repetitive Peak Forward Surge Current (sin 1)</td>
<td>I(TM)</td>
<td>25</td>
<td></td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>Non-Repetitive Peak Reverse Surge Current (sin 1)</td>
<td>I(RM)</td>
<td></td>
<td></td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>Forward Voltage (Note 6)</td>
<td>Vf</td>
<td></td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Peak Reverse Leakage Current at Rated DC Blocking Voltage (Note 2)</td>
<td>I(RM)</td>
<td>10</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Typical Total Capacitance (Note 3)</td>
<td>Cj</td>
<td>110</td>
<td></td>
<td></td>
<td>pF</td>
</tr>
<tr>
<td>Typical Thermal Resistance Junction to Lead (Note 4)</td>
<td>Rth(L)</td>
<td>15</td>
<td></td>
<td></td>
<td>°C/W</td>
</tr>
<tr>
<td>Typical Thermal Resistance Junction to Ambient</td>
<td>Rth(A)</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating and Storage Temperature Range</td>
<td>T(T)</td>
<td>-40 to +125</td>
<td></td>
<td></td>
<td>°C</td>
</tr>
</tbody>
</table>
Alkaline Pack for Logger

- Industrial Energizer D Cell x 24
- 9V open circuit
- Each cell is fused
- Each series string is diode protected

www.probatteryspecialists.com

In house battery pack fabrication

Pro Battery Specialist - pack fabrication

Test points

www.probatteryspecialists.com
**Alkaline Clock Pack**

**Purpose:** provide power to
Keep the system clock running
In the event that the main battery output voltage drops below cutoff.
If the clock can be kept running in a lower power mode (PLL off) the system’s total drift can still be determined upon recovery.

- 2 x Energizer D cells
- 3VDC nominal output
- ~17Ah @ 25mA, 21C
- Configuration: 2S
Energizer D Cell Specification

**ENERGIZER E95**

**Specifications**
- **Classification:** Alkaline
- **Chemical System:** Zinc-Manganese Dioxide (Zn/MnO₂)
- **No added mercury or cadmium**
- **Designation:** ANSI-13A, IEC-LR20
- **Nominal Voltage:** 1.5 volts
- **Nominal IR:** 150 to 300 milliohms (fresh)
- **Operating Temp:** -18°C to 55°C (0°F to 130°F)
- **Typical Weight:** 144.0 grams (5.1 oz.)
- **Typical Volume:** 56.0 cubic centimeters (3.4 cubic inch)
- **Jacket:** Plastic Label
- **Shelf Life:** 10 years at 21°C
- **Terminal:** Flat Contact
- **Manufactured:** Made in the USA

**Industry Standard Dimensions**

- **Maximum:** 34.20 (1.346)
- **Minimum:** 1.59 (0.059)

**Milliamp-Hours Capacity**

Continuous discharge to 0.8 volts at 21°C

- **Capacity (mAh):**
  - 25: 18000
  - 100: 12000
  - 250: 6000
  - 500: 6000
# Acoustic Release Battery Pack

## 9V Battery Side

- **Output Voltages:** +18V Release, +12V Reply, +9V Electronics
  - 11x 9V Energizer Batteries
  - 24x AA Energizer Batteries

## Supply Voltage

<table>
<thead>
<tr>
<th>Supply Voltage</th>
<th>Configuration</th>
<th>Capacity (Ah)</th>
<th>Nominal Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>+18V (Release)</td>
<td>24 x AA batteries 2 x series banks of 12 cells in parallel 16 of the cells are part of the +12V supply</td>
<td>6 Ah @ 25mA, 21C 3 Ah @ 0.5A, 21C</td>
<td>&lt;1uA Que., 2A typ. active</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 Ah @ 25mA, 21C 3 Ah @ 0.5A, 21C</td>
<td></td>
</tr>
<tr>
<td>+12V (Reply)</td>
<td>16 x AA batteries 2 x series banks of 8 cell in parallel</td>
<td>6 Ah @ 25mA, 21C 3 Ah @ 500mA, 21C</td>
<td>&lt; 1uA Que., 500mA max</td>
</tr>
<tr>
<td>+9V (Electronics)</td>
<td>11 x 9V batteries in parallel</td>
<td>1.44 Ah @ 25mA, 21C</td>
<td>275uA typ.</td>
</tr>
</tbody>
</table>
Acoustic Release Battery Pack Schematic
Acoustic Release Battery Pack

**Cell Specs**

**ENERGIZER 522**

- **Classification:** Alkaline
- **Chemical System:** Zinc-Manganese Dioxide (Zn/MnO₂)
- **Designation:** ANSI-1604A, IEC-3LR01
- **Nominal Voltage:** 9.0 volts
- **Operating Temp:** -18°C to 55°C (0°F to 130°F)
- **Typical Weight:** 45.6 grams (1.6 oz.)
- **Typical Volume:** 23.1 cubic centimeters (1.3 cubic inch)
- **Jacket:** Metal
- **Shell Life:** 5 years at 21°C
- **Terminal:** Miniature Snap

**Industry Standard Dimensions (mm [inches]):**
- 17.50 (0.689)
- 15.50 (0.610)
- 12.95 (0.510)
- 12.45 (0.490)
- 26.50 (1.043)
- 24.50 (0.965)
- 46.40 (1.827) Maximum
- 46.50 (1.833) 46.50 (1.833)

**Millamp-Hours Capacity**

- Continuous discharge to 4.8 volts at 21°C

**ENERGIZER E91**

- **Classification:** Alkaline
- **Chemical System:** Zinc-Manganese Dioxide (Zn/MnO₂)
- **Designation:** ANSI-13A, IEC-LR6
- **Nominal Voltage:** 1.5 volts
- **Nominal Impedance:** 150 to 300 milliohms (fresh)
- **Operating Temp:** -18°C to 55°C (0°F to 130°F)
- **Typical Weight:** 23.0 grams (0.8 oz.)
- **Typical Volume:** 8.1 cubic centimeters (0.5 cubic inch)
- **Jacket:** Plastic Label
- **Shell Life:** 10 years at 21°C
- **Terminal:** Flat Contact

**Industry Standard Dimensions (mm [inches]):**
- 14.50 (0.571)
- 13.50 (0.531)
- 11.00 (0.433)
- 5.50 (0.217) Maximum
- 5.50 (0.217) 5.50 (0.217)

**Millamp-Hours Capacity**

- Continuous discharge to 0.8 volts at 21°C

**Discharge (mA):**
- 25, 100, 300, 500

**Capacity (mAh):**
- 0
- 100
- 200
- 300
- 400
- 500
- 600
- 700
- 800

**Typical:**
- 7.00 (0.276) Minimum
- 50.50 (1.988)
- 40.50 (1.594)

**Average:**
- 0.10 (0.004) Typical
- 7.00 (0.276) Minimum
- 50.50 (1.988)
- 40.50 (1.594)
Battery Connection - Flex Cables

Parallel Connection of Batteries

433 Series Littlefuse, very fast acting 1A - 1206 size

<table>
<thead>
<tr>
<th>% of Ampere Rating</th>
<th>Opening Time at 25°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>4 hours, Minimum</td>
</tr>
<tr>
<td>200%</td>
<td>5 sec., Maximum</td>
</tr>
<tr>
<td>300%</td>
<td>0.2 sec., Maximum</td>
</tr>
</tbody>
</table>
Battery Connection - Flex Cables

Series Connection of Batteries

433 Series Littlefuse, very fast acting 1A - 1206 size

<table>
<thead>
<tr>
<th>% of Amperes Rating</th>
<th>Opening Time at 25°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>4 hours, Minimum</td>
</tr>
<tr>
<td>200%</td>
<td>5 sec., Maximum</td>
</tr>
<tr>
<td>300%</td>
<td>0.2 sec., Maximum</td>
</tr>
</tbody>
</table>
Battery Connection - Flex Cables

Flex Cable taped along top of battery packs
Cell Type: CSC DD
Nominal Cell capacity: 30 Ah
Configuration: 4S, 7P
Pack nominal capacity: 210 Ah
Cell Count: 28
Voltage: 15.6

- Save shipping cost
- Reduce turn around time
- Ability to run multiple cruises from a single pack

<table>
<thead>
<tr>
<th>Capacity Pin Voltage</th>
<th>Battery Capacity Withdrawn</th>
</tr>
</thead>
<tbody>
<tr>
<td>4V</td>
<td>capacity withdrawn &lt; 25%</td>
</tr>
<tr>
<td>3V</td>
<td>25% &lt; capacity withdrawn &lt; 50%</td>
</tr>
<tr>
<td>2V</td>
<td>50% &lt; capacity withdrawn &lt; 75%</td>
</tr>
<tr>
<td>1V</td>
<td>capacity withdrawn &gt; 75%</td>
</tr>
<tr>
<td>0V</td>
<td>No indication, battery in low power mode</td>
</tr>
</tbody>
</table>

Low Power Pin connection Mode

- No connection: Active Mode, 500uA draw on pack battery current monitored
- PowerOut(-): Low Power Mode, 46uA draw on pack Battery current NOT monitored

Save shipping cost
Reduce turn around time
Ability to run multiple cruises from a single pack
Electrochem pack with fuel gauge monitor
Thank You!

Questions?