

**“Everything you  
always wanted  
to know about  
Batteries\*  
\*But were afraid to ask”**

# MULTIPLIER™

## A Worldwide Leader with locations in

- Boston, MA
- San Diego, CA
- Mason City, IA
- Tijuana, Mexico
- United Kingdom
- China
- Malaysia

# MULTIPLIER™

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# Anatomy of a Battery

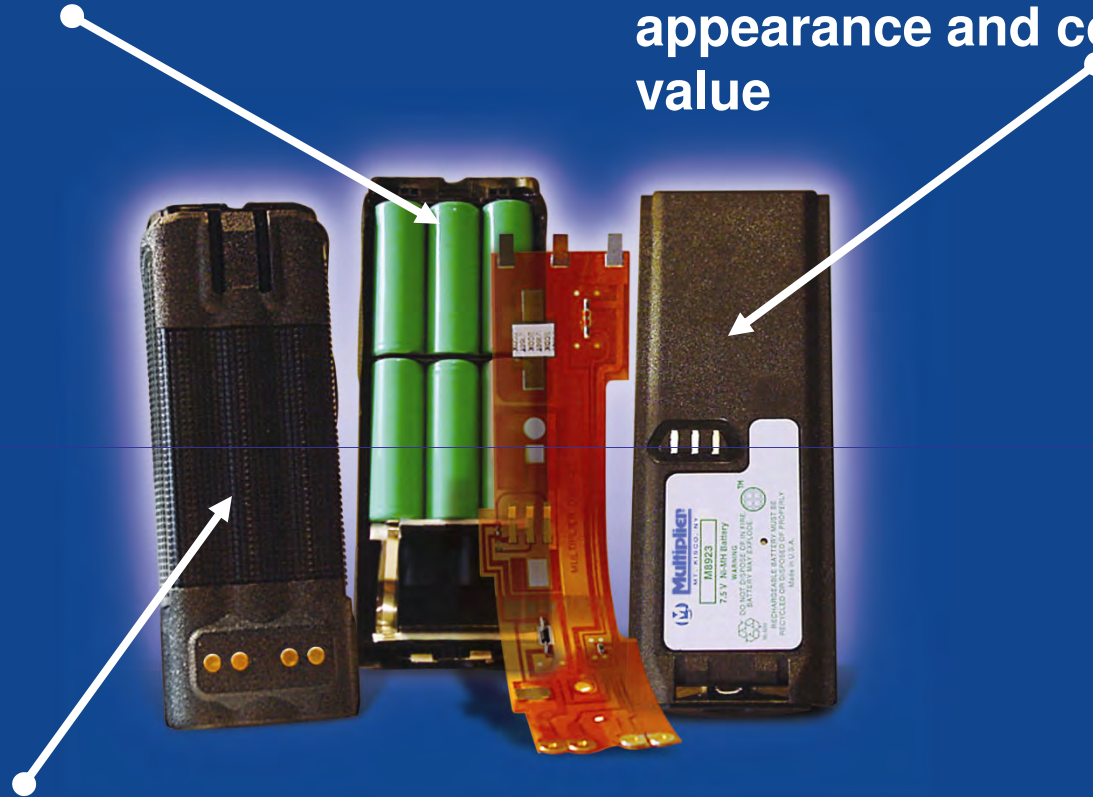
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Proper cell selection guarantees maximum performance and life cycle. Only the highest quality components, cells and materials are used.

100% final QC of every battery includes verification of durability, fit, charge, appearance and component value



Custom designed molds yield precise dimensional tolerances and accurately duplicate OEM specifications



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**Rechargeable batteries don't suddenly go to zero capacity and die. They fade over time.**



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# Battery Chemistries

- **Alkaline**
- **Ni-Cd Nickel Cadmium**
- **Ni-MH Nickel Metal Hydride**
- **Li-Ion Lithium Ion**
- **Primary Lithium**
- **Li-Polymer**
- **Fuel Cell**

# Alkaline Advantages

- **Inexpensive to purchase**
- **Environmentally friendly**
- **Low maintenance**
- **Non-rechargeable versions**  
**are good backup and emergency use**



# Alkaline Disadvantages

- **Limited life**
- **Higher overall cost compared to rechargeables over time**
- **Higher cost of use compared to rechargeables over time**
- **Less usable capacity as compared to rechargeables in high drain applications**

# Ni-Cd Advantages

- **Most commonly used cell**
- **Economical**
- **High Currents @ Relatively Constant Voltage**
- **Tolerant of Physical Abuse**
- **Longest Cycle Life**
- **Good Storage Characteristics**
- **High Energy Density**
- **Wide Ambient Temperature Range-Charging**



# Ni-Cd Disadvantages

- **Cadmium is Toxic**
- **Not Bio-degradable**
- **Lowest Duty Cycle**
- **Memory Effect**

# Ni-MH Advantages

- **Higher Energy Density - more talk/standby time per charge**
- **Longer Duty Cycle**
- **Environmentally Friendly**
- **Minimum Memory Effect**
- **High Power Performance**



# Ni-MH Disadvantages

- **Shorter Cycle Life-70% Ni-Cd**
- **Low Heat Tolerance**
- **Self Discharges with non-use**
- **Higher Cost**
- **Shorter Ambient Temperature Range**

# Li-Ion Advantages

- **Light Weight – makes radio package lighter**
- **Longer Talk/Standby Time**
- **Very High Energy Density**
- **Longest Duty Cycle**
- **Environmentally Friendly**
- **No Memory Effect**



# Li-Ion Disadvantages

- **Lowest Cycle Life-30% Ni-Cd**
- **Very Low Tolerance to Heat**
- **Highest Cost**
- **Volatile**
- **Overcharge/Discharge Protection required**

# Li-Polymer

- **The up and coming technology**
- **All the advantages of Li-Ion and more...**
  - **Moldable into battery shape**
  - **More stable than Li ion**
  - **High energy density**
- **Not widely used yet...**
  - **Cost**
- **Multiplier working on some models...stay tuned**

# Fuel Cell Advantages

- **System that uses hydrogen to create power with water byproduct**
- **High energy density**
- **Good in applications where AC charging not readily available**
- **5:1 advantage in weight over comparable batteries**

# Fuel Cell Disadvantages

- **High cost**
- **Large quantity of heat produced in cell**
- **Consume a reactant, which must be replaced**
- **Cannot store energy like a battery, need their own battery**

# Battery Chemistry Comparison

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# Battery Capacity as a function of temperature and chemistry

	<b>Ni-Cd</b>	<b>Ni-MH</b>	<b>Li-ion</b>
<b>115° F</b>	90%	85%	85%
<b>100° F</b>	95%	85%	105%
<b>70° F</b>	100%	100%	100%
<b>32° F</b>	80%	85%	80%
<b>0° F</b>	65%	10%	15%
<b>Cycles/Life-80% Capacity</b>	500 – 700	300 – 500	300 - 500

# Selecting Your Battery Chemistry

- **Ni-Cd is best for:**
  - **Long cycle life**
  - **transmitting at 4W of power in relatively high ambient temperatures**

# Selecting Your Battery Chemistry

- **Ni-MH batteries are:**
  - **More environmentally friendly**
  - **Higher energy density and longer duty cycle than Ni-Cd**
  - **Discharge current profile is lower**

# Selecting Your Battery Chemistry

- **Choose Li-Ion when:**
  - **Looking for long duty cycles with lighter weight**
  - **Operating in low to moderate ambient temperatures**

# Battery Care:

## *Initial Break-In and Storage*

- **With new batteries, charge 16-24 hours before using**
- **Before using new batteries, charge & discharge three times**
- **Best to store at 40% charge with most chemistries**
- **Cool storage temperatures are key**

# Battery Care: *Charging*

- **Ideal to make every third charge a condition/charge**
- **Resist “topping off” the battery**
- **If voltage depression detected, do condition/charge**
- **Some cells need to be removed upon full charge  
– check your chemistry requirements**

# Battery Care: *Temperatures*

- **Let battery cool after charging before use**
- **Charging hot battery may alter charge efficiency**
- **With slow or fast charge maximum temp is 113°F**
- **Rechargeables can be used in wide range of temps**

# Rechargeable Battery Disposal

- **Best disposal method for any battery is to use a recycling facility**
- **The Rechargeable Battery Recycling Corporation (RBRC) can recycle Ni-Cd, Ni-MH and Li-Ion batteries (visit [www.call2recycle.org](http://www.call2recycle.org))**
- **Because of heavy metal content, critical to recycle Ni-Cd batteries**
- **Multiplier is a licensee of RBRC, supporting the *Call2Recycle* program**

# OEM vs. Aftermarket

- **Higher capacities available in aftermarket batteries**
- **More chemistries than OEM offers**
- **Compatible in fit and function with device and chargers**
- **Lower cost**

# Why Choose Multiplier?

- **35 Year history supplying the most reliable power solutions for the communications industry**
- **OEM Quality**
- **ISO9001/2000 Certified, Engineering, Design and Manufacturing**
- **Over 32 Factory Mutual Certified/Intrinsically Safe Batteries**
- **In House Technical/Engineering Support**

# Why Choose Multiplier?

- **World Class Customer service**
  - **Friendly, knowledgeable, accessible**
- **AFTP (Advanced Field Testing Program)**
- **10,000 Batteries/Day: 9/11, Katrina**
- **100% Responsible**

# Multiplier Quality

- **Recognized Worldwide for Consistency**
- **In House Technical/Engineering Support**
- **< 1/2 of 1% Product Returned Defective**
- **15% of Mfg. Dedicated to QC**
- **Huge Inventory**



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# Multiplier Quality

- **Highest Quality Cells-Panasonic/Sanyo**
- **Highest Impact Polycarbonate-No Recycled Materials**
- **Highest Quality Components**
- **Flex Boards-Efficient, Accurate**
- **Own all Molds & Tools**



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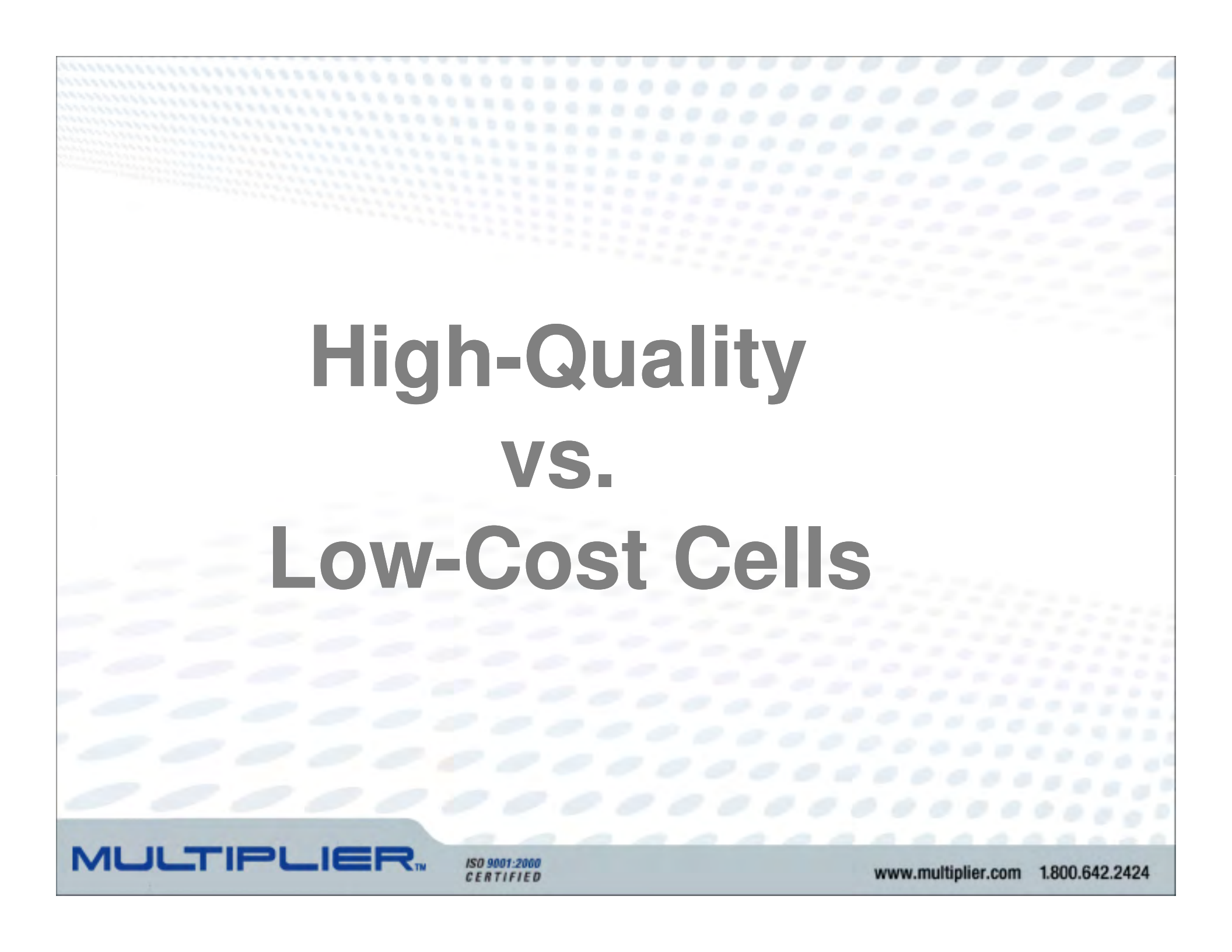
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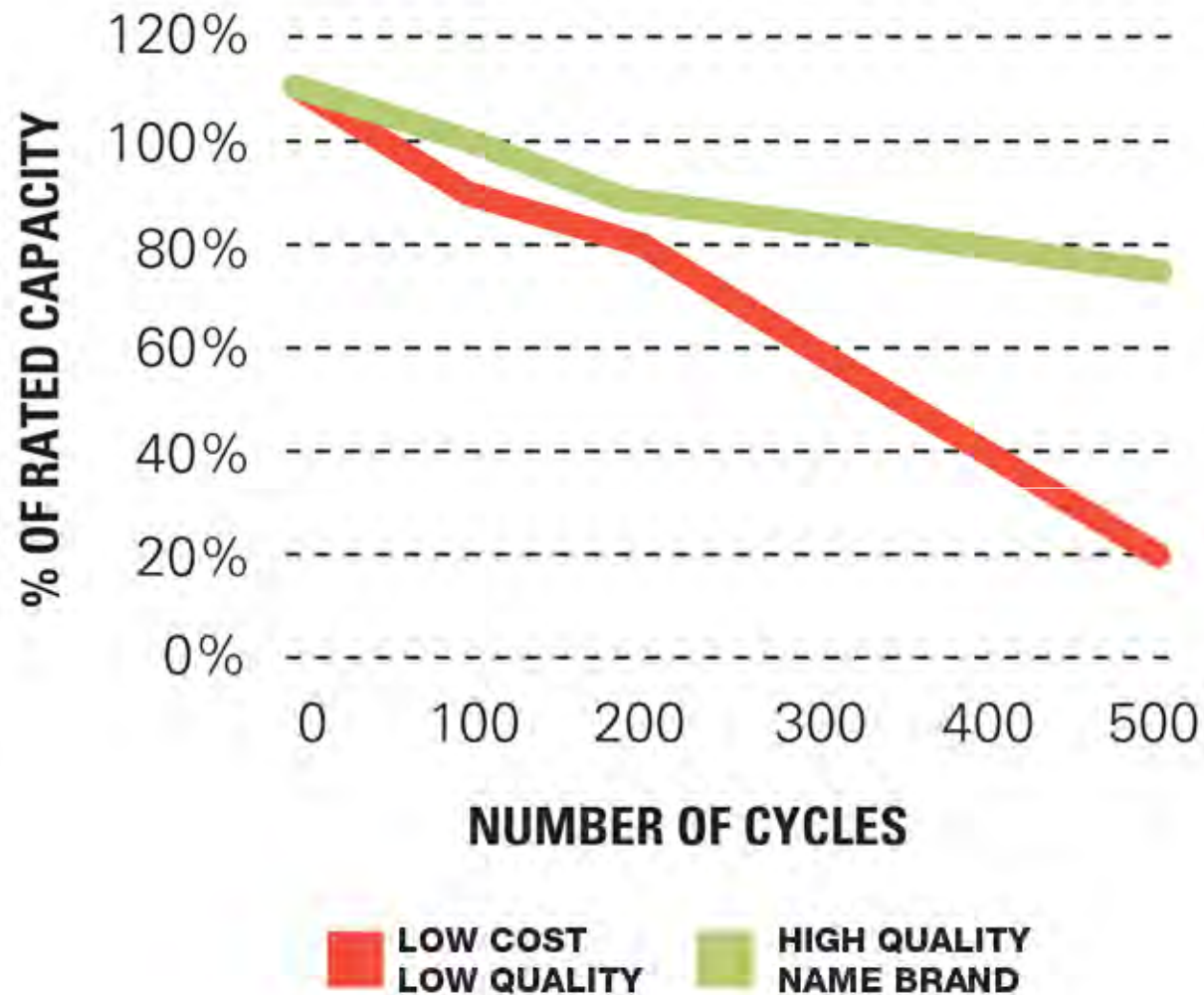
# High-Quality vs. Low-Cost Cells

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## CAPACITY AND CYCLES OF CELLS



# Multiplier uses only High-Quality Cells

- **Only high quality cells hold capacity through 300-500 cycles**
- **Multiplier guarantees at least 80% capacity for 12 months for Ni-MH and Li, and 18 mo for NiCd**

# What To Look For In Defect Rates

- Look for less than  $\frac{1}{2}$  of 1% product defect rates
- Ask for factory records on defective batteries
- Ask how much factory manpower is dedicated to QC



# Why use Intrinsically Safe Batteries?

- **Intrinsically safe batteries required in oil & gas operations and other environments where sparks may cause combustion**
- **Intrinsically safe batteries are certified by FM for operation as part of a radio system**
- **Higher degree of safety**

# FM Certified Intrinsically Safe

- **Over 32 FM Certified IS Batteries**
- **FM Certified, *not* “Self-certified”**
- **All IS Batteries subjected to AFTP (Advanced Field Testing Program)**



# Multiplier Customer Survey

- **96%-Equal to or Better than OEM**
- **98.6%-Equal to/Superior Other Suppliers**
- **96%-Pricing Equal to or Superior**
- **99%-Best in Technical Support**
- **99.1%-Best Customer Service**
- **99%-Delivery on Time/Earlier**

# Multiplier Customer Service



- **Based in the U.S.**
- **Always available by e-mail or toll free 800 number**



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