



Quality and TCO Analysis: 2- and 12-Volt Batteries in Telecommunication Applications

What's Inside?

- 2 The product of choice
- 3-4 TCO analysis
- 5-7 The exclusive East Penn way
- 8 The environmental value behind the product and company profile

“The 2-volt battery has proven to be the best solution for cell sites with shelters and indoor switching facilities.”

The use of wireless communication devices is growing at an exponential rate. To keep these devices working at optimal levels, expanding the worldwide infrastructure of cellular towers is critical. To also keep these new cellular towers working at optimal levels, installing a dependable system of batteries that provide instantaneous reserve power is just as essential.

As network expansion costs continue to rise, one must carefully weigh the most efficient and overall cost effective backup power system to support this progression in the wireless industry. When choosing the right battery system, it's important to realize that optimal efficiency can only be achieved by utilizing the highest quality battery designs that deliver the longest life and are poised to meet the unique demands of the intended telecom application.

The 2-volt battery has proven to be the best solution for cell sites with shelters and indoor switching facilities. While 12-volt batteries are an ideal fit for certain applications, the 2-volt product saves costs on initial set-up, maintenance and replacement, and overall life. From the grid design to the final assembly process, these batteries are built with the right features and perfected techniques ensuring the lowest cost of ownership.

By utilizing a Total Cost of Ownership analysis, it is clear that the savings from the Deka Unigy II 2-Volt solution are substantial. For each location, these **savings can reach up to \$14,100 or more.** In addition to saving thousands of dollars, these batteries have **two times (2x) the design life and fit in the same footprint** as 12-volt batteries.

East Penn, with over 63 years of experience in the industry, including over 23 years of Valve Regulated Lead-Acid (VRLA) experience, manufactures both 2-volt and 12-volt battery solutions. The company is on the forefront of the latest technology with its leading-edge VRLA AGM (Absorbed Glass Mat) battery designs. Using the industry's finest raw materials and exclusive manufacturing processes, East Penn delivers the best quality, performance, and cost effective battery solutions for any telecom application. ■

DEKA UNIGY II 2-VOLT

The Product of Choice

More robust internal components

While all Deka grid and plates are made with the same technology and quality controlled processes, the design of the Deka Unigy II 2-volt grids and plates are thicker and more rugged. This unique construction allows for the 2-volt battery to provide a slower, longer discharge of energy deep within the plates.

All Deka Unigy batteries are made with an exclusive valve that releases pressure and quickly self-seals to prevent oxygen from entering the battery. Unigy II batteries have a special MICROCAT™ Catalyst built into the valve. This Catalyst assists the battery with the recombination process by lowering float current, decreasing internal temperatures, and decreasing the rate of drying out.

Minimal battery connections

In comparing a 2000 AH plant system, one string of a 2-volt solution has only 2 external connection points while a comparable system using 12-volt batteries has 12 times that amount. Every one of these many points represents a potential maintenance concern and requires additional time to monitor the system over the life of the product.

Less time for cell checking procedures

Using a 2-volt solution allows the user to check each cell individually. For example, a 24-volt 2000 AH system has twelve 2-volt cells. This equals checking twelve individual cells. In a comparable 24-volt 2040 AH system of 12-volt 170 AH batteries, there are 24. This doubles labor and testing time.

With 12-volt batteries, only the complete battery can be checked, not each individual cell (a 24-volt 2040 AH system has 144 cells). The inability to check a 12-volt battery on a cell-by-cell level can create a higher potential for future battery problems such as early failure due to under-performing cells.

Modified for any application

The footprint of a 2-volt solution can be modified with both various module sizes and stacking arrangements, allowing for custom design by application and does not require a larger footprint than a cabinet solution. In contrast, a 12-volt battery is restricted to the existing cabinet designs available on the market.

Installation labor comparable with 12-volt

While 2-volt installations may require equipment to assist in installation, installing a 12-volt battery is not a one-person job. 12-volt batteries can each weigh 120 lbs. and may need to be lifted up to 69" high. Even if it were possible, it is extremely dangerous for one person to install a 12-volt battery without the proper lifting equipment.

Extremely high reliability rate

East Penn firmly stands behind the quality and reliability of its 2-volt product. At a recent network installation, East Penn installed over 130,000 2-volt cells with a failure rate of .002%. While reliability may be more of an issue with other competitive product offerings, East Penn batteries have an extremely low defect rate. ■

TCO ANALYSIS

The Deka Unigy II 2-Volt Solution

Product life and costs are critical factors in a Total Cost of Ownership (TCO) analysis of telecom battery systems. Based on the example in Chart A that compares 2-volt vs. 12-volt batteries in a 24-volt system, with one battery system per location, the 2-volt would provide potential savings of over **\$14,100 per location**. Those savings become exponential when applied to multiple remote battery locations.

Chart A

12-volt batteries – 2040 AH			
COSTS	WARRANTY	DIMENSIONS	TOTAL
(24) 12AVR170ET batteries ^{1,5}	10 year warranty		\$16,708.56
(1) Battery cube rack		26"W x 24"D x 84"H	\$2,485.00
(24) 12AVR170ET batteries – replacement ²			\$19,308.00
Testing ⁴			\$1,200.00
Total system cost			\$39,701.56
Cost of ownership			\$19.46/per AH³

2-volt batteries – 2000 AH — Example #1			
COSTS	WARRANTY	DIMENSIONS	TOTAL
12 cells 2x6 configuration ^{1,5}	20 year warranty	27"W x 31"D x 81"H	\$26,754.00
Testing			\$600.00
Total system cost			\$27,354.00
Cost of ownership			\$13.77/per AH³

2-volt batteries – 2000 AH — Example #2			
COSTS	WARRANTY	DIMENSIONS	TOTAL
12 cells 3x4 configuration ^{1,5}	20 year warranty	40"W x 31"D x 57"H	\$24,964.00
Testing			\$600.00
Total system cost			\$25,564.00
Cost of ownership			\$12.78/per AH³

1 - Includes product cost only. Shipping and labor costs are similar for both systems.

2 - 12-volt Unigy I batteries will need to be replaced once during life of 2-volt product. See Chart B for replacement battery cost and analysis.

3 - Cost per AH calculated by dividing total system cost by total system AH.

4 - Testing costs reflect double the number of 12-volt batteries vs. 2-volt cells.

5 - Price reflects suggested list and may vary.

TCO ANALYSIS

Replacement Battery Cost

As a 12-volt battery has half the design life of a 2-volt, the user will have to replace their 12-volt batteries during the same life period. The below analysis details all the costs involved when replacing 12-volt batteries.

Chart B

Replacement battery cost analysis		
COSTS	LABOR³	TOTAL
Replacement battery cost (24) 12AVR170ET ^{1,2}		\$16,708.00
Purchase order processing	2 Hrs	\$100.00
Freight (24 batteries shipping an average distance)		\$250.00
Warehouse, storage and handling (1 pallet)		\$150.00
Total for replacement batteries, purchase order, and warehousing		\$17,208.00
REMOVAL/INSTALLATION/SCRAP BATTERY PREPARATION	LABOR	TOTAL
Picking up batteries at warehouse	3 Hrs	\$150.00
Transportation to site (Average)	3 Hrs	\$150.00
Removal/Installation		\$1,500.00
Transportation back from site	3 Hrs	\$150.00
Scrap return preparation	3 Hrs	\$150.00
Total for removal and replacement		\$2,100.00
Increased cost of ownership for replacing 12-volt batteries		\$19,308.00

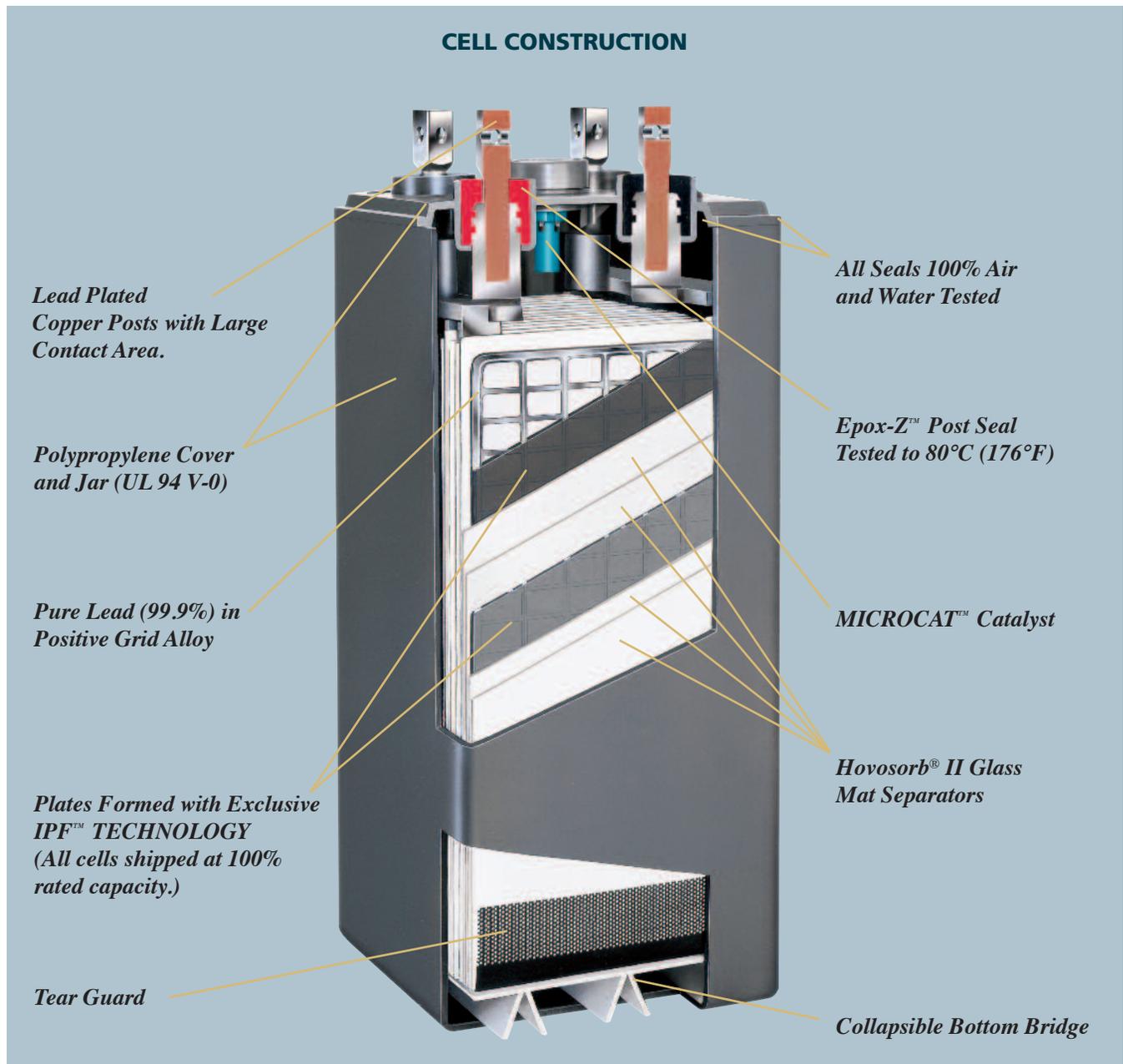
1 - Prices reflects suggested list and may vary.

2 - Assuming 12 year battery life.

3 - Assuming an hourly rate of \$50 (not fully burdened).

THE EXCLUSIVE EAST PENN WAY

Deka Unigy Manufacturing Process



Grid Alloy and Casting

The internal supporting framework of the battery is called a grid. Grids serve as a path for transferring electrical current. The positive grid contains a pure virgin lead (99.99%) and a tin alloy. The negative grid is also alloyed with a premium lead cal-

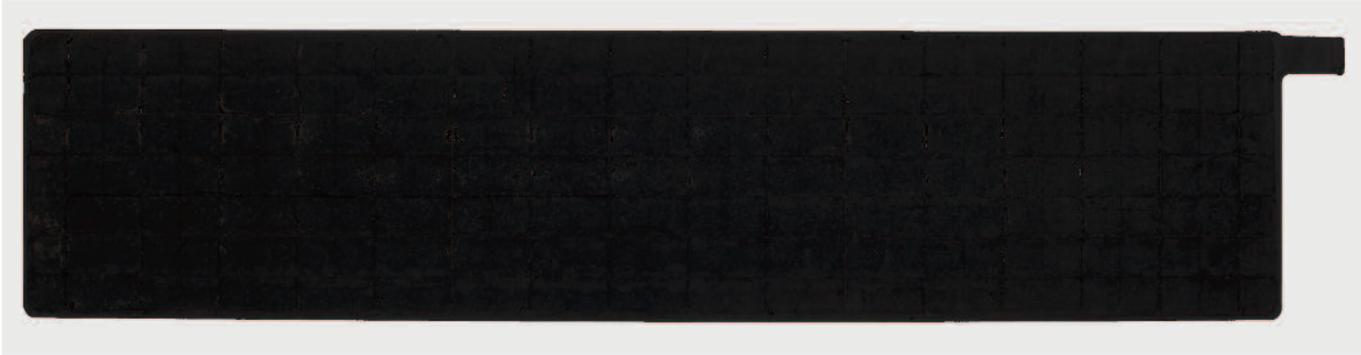
cium blend. The amount of pure virgin lead alloy used in the grid increases the battery's conductivity capabilities and resists internal corrosion to extend battery life. The grid's precise alloy blend and tested structural integrity withstands the naturally corrosive action of the acid while limiting side

effects such as plate growth. Proper grid casting ensures reliable performance and optimizes battery design life.

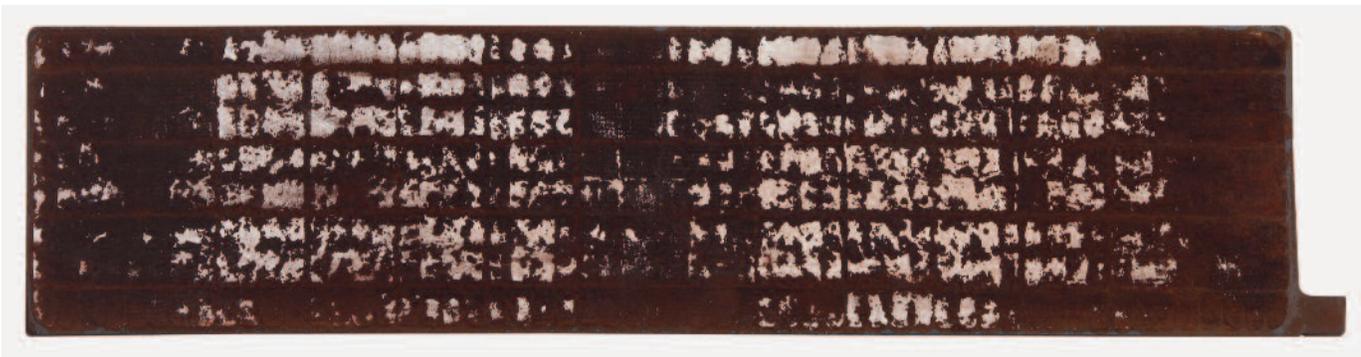
Proprietary Formula Pasting

East Penn's active material, also referred to as "paste," is composed of

PLATE FORMATION



Fully formed Deka plate using IPF™ TECHNOLOGY. This superior process is exclusive to East Penn.



Competitor's plate formed in the battery case. White areas indicate plate is not fully formed.

a mixture of sulfuric acid, water, and a specially formulated lead oxide. Deka Unigy VRLA battery oxide is made with pure virgin lead (99.99%) and manufactured with a proprietary and exclusive formula made on-site at its own oxide mills. A unique computerized mixing system allows the combination of these materials to be precisely mixed into a paste-like consistency. The paste is uniformly and automatically applied to the grid by computer-integrated pasting

machines creating a plate. The plate stores the battery's power that is transferred by the grid. East Penn's exacting process for applying the correct amount and density of paste is critical for capacity and life.

IPF™ Technology Formation

Deka Unigy batteries go through an exclusive two-step formation/charging process to guarantee performance and consistency. First, each Deka Unigy plate is formed individually

with IPF (Individual Plate Formation) Technology. East Penn is the only manufacturer in the U.S. to use IPF Technology. After formation, each plate is visually inspected to ensure its complete formation. IPF Technology provides precision temperature and voltage control, guaranteeing maximum and uniform performance from every plate and ultimately each cell. The second step is placing the cell through a boost charging phase where the cells are charged and optimized

for long life. **Using this two-step process guarantees all Deka Unigy batteries ship at 100% of rated capacity, exceeding the industry standard.** In addition, using this formation technique requires no equalizing charge by the end user. This saves the customer both time and money.

Other manufacturers form the fully assembled cell directly in the battery case, preventing a visual inspection to determine if the plates are completely formed without tearing apart the battery. This formation process does not

guarantee a fully formed plate, cell, or battery string, creating an environment prone to unequal plate formation leading to unequal cell-to-cell voltages. Batteries with unequal voltages require future equalize charges adding to the battery's total cost of ownership and the unreliability of the product.

The Valve and MICROCAT™ Catalyst

Another unique advantage to all Deka Unigy batteries is its exclusive valve. The valve, manufactured by East Penn, is 100% tested for

specific opening, closing, and back pressure. It releases pressure and quickly self-seals to prevent oxygen from entering the battery. Deka Unigy II batteries feature the MICROCAT Catalyst built into the valve. This catalyst assists the battery with the recombination process by lowering float current, decreasing internal temperatures, and decreasing the rate of drying out. This is one of the special features of Unigy II battery systems that enable a long design life of 20 years. ■

THE VALUE BEHIND THE PRODUCT

Environmental Stewardship and Innovative Recycling



East Penn has a long history of industry leadership with environmental responsibility and good stewardship. Surrounded by thousands of acres of fertile farmland, East Penn strives to preserve the environment.

Since 1946, East Penn has made safe recycling an everyday practice. The company began as a battery rebuilding company, cleaning and repairing old batteries for reuse. More than 60 years later, East Penn operates the industry's most technologically advanced recycling facility where thousands of batteries are recycled

a day. This on-site smelter saves transportation costs of 100,000 tons of lead from off-site locations and allows tighter controls of lead quality. The facility has been selected as a model site by the U.S. EPA.

Its Lyon Station, Topton, and Kutztown facilities are certified to ISO14001 Environmental Management System standards. These standards are recognized worldwide and prove a company's compliance to a complete environmental management system, helping to protect the environment for future years to come.

East Penn's dedication to safe battery recycling means complete commitment to proper battery disposal. The customer will never have to worry about hefty fines, penalties, or paperwork burdens associated with hazardous waste disposal laws. East Penn's modern facilities and good stewardship makes it the most environmentally conscious and proactive battery manufacturer in the world. ■



Since 1946, East Penn has been producing high quality batteries for the stationary, industrial, automotive, commercial, marine and specialty markets. A progressive company committed to the future, East Penn operates the largest single-site manufacturing facility in the industry with vertical integration capabilities that encompass every stage of battery

production. The company also operates a manufacturing facility in Corydon, IA to help accommodate the company's widespread growth. To keep up with the increasing demand for high quality products, East Penn is pursuing an aggressive expansion plan. In fact, the new high-tech facilities and computer monitoring and control systems

have made the company the industry's most technologically advanced battery manufacturer.

Facilities at its 520-acre single-site manufacturing complex in Lyon Station, PA include four automotive plants, an industrial battery plant, a specialty battery plant, a state-of-the-art oxide facility, an acid reclamation plant, three modern

technical centers, an EPA permitted lead smelter and refinery, a pilot manufacturing test plant, two water purification plants, a fully equipped machine shop, two injection molding plants, a fleet repair and maintenance garage, plus dozens of other support facilities. Just miles away, East Penn owns and operates a wire, cable, and battery accessory plant and a large distribution center complex fully stocked with an extensive inventory of our high-quality products.

The quality of East Penn's products is recognized worldwide and has met the global requirements of ISO 9001 and ISO/TS 16949 certification standards.

Staffed with a long-term management team, East Penn is an independent company dedicated to producing high-class products and service supported by East Penn's exclusive advantages to assure complete satisfaction and beyond to its partners and customers worldwide. ■

"POWERED FOR PERFORMANCE"®

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