



Quality and TCO Analysis: UPS Backup Lead-Acid Battery Technology

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“East Penn’s VRLA technology has many proven advantages in terms of TCO analysis factors over the traditional flooded design.”

In today’s modern information age, no one can question the critical nature of Uninterruptible Power Systems (UPS) and the battery systems designed to save vital electronic information. As batteries are called upon to deliver megawatts of power in a mere instant, unreliability and inferior performance can result in the loss of terabytes of irretrievable data equating to a significant financial loss and poor customer relations. When choosing the right battery system, there is no doubt that high quality is the top priority in order to service one of society’s most essential needs.

In order to provide the best battery solutions to the critical data center marketplace, a high quality battery system must also fit within financial considerations and facility space limitations to deliver the **lowest Total Cost of Ownership (TCO)** over the life of the batteries. East Penn’s advanced Deka Unigy T4 system provides this superior battery solution with More Power. Less Space™. These batteries provide unmatched quality and a **greater overall value above and beyond typical flooded battery technology**, especially in UPS applications. Utilizing its long-term expertise in battery manufacturing and design, East Penn uses the industry’s finest raw materials and exclusive manufacturing processes to create a product that delivers undeniably the best quality and performance. The quality of East Penn’s VRLA battery systems have proven to deliver greater value in reliability, and overall cost savings to the customer than flooded systems.

Although experts at both VRLA and flooded battery manufacturing, East Penn developed *VRLA technology for UPS applications. East Penn’s VRLA technology has many proven advantages in terms of TCO analysis factors such as space, safety, ease of installation, and maintenance over the traditional “flooded” design.* This is especially beneficial in the critical data center market where extended cost projections and space considerations are an essential part of the decision making process.

The Deka Unigy T4, the newest line of Deka Unigy VRLA product, was developed specifically for the critical data center market. Designed for Tier 4 reliability, it complies with the rigid and stringent guidelines of data centers and web hosting environments. Its design and technology, backed by proven field experience, translates to a key facet: “More Power. Less Space.”

In fact, the Deka Unigy T4 will reduce floor space by as much as 50% and provide more power in the same footprint than any flooded product on the market.

QUALITY ANALYSIS: THE MANUFACTURING PROCESS

VRLA product for UPS

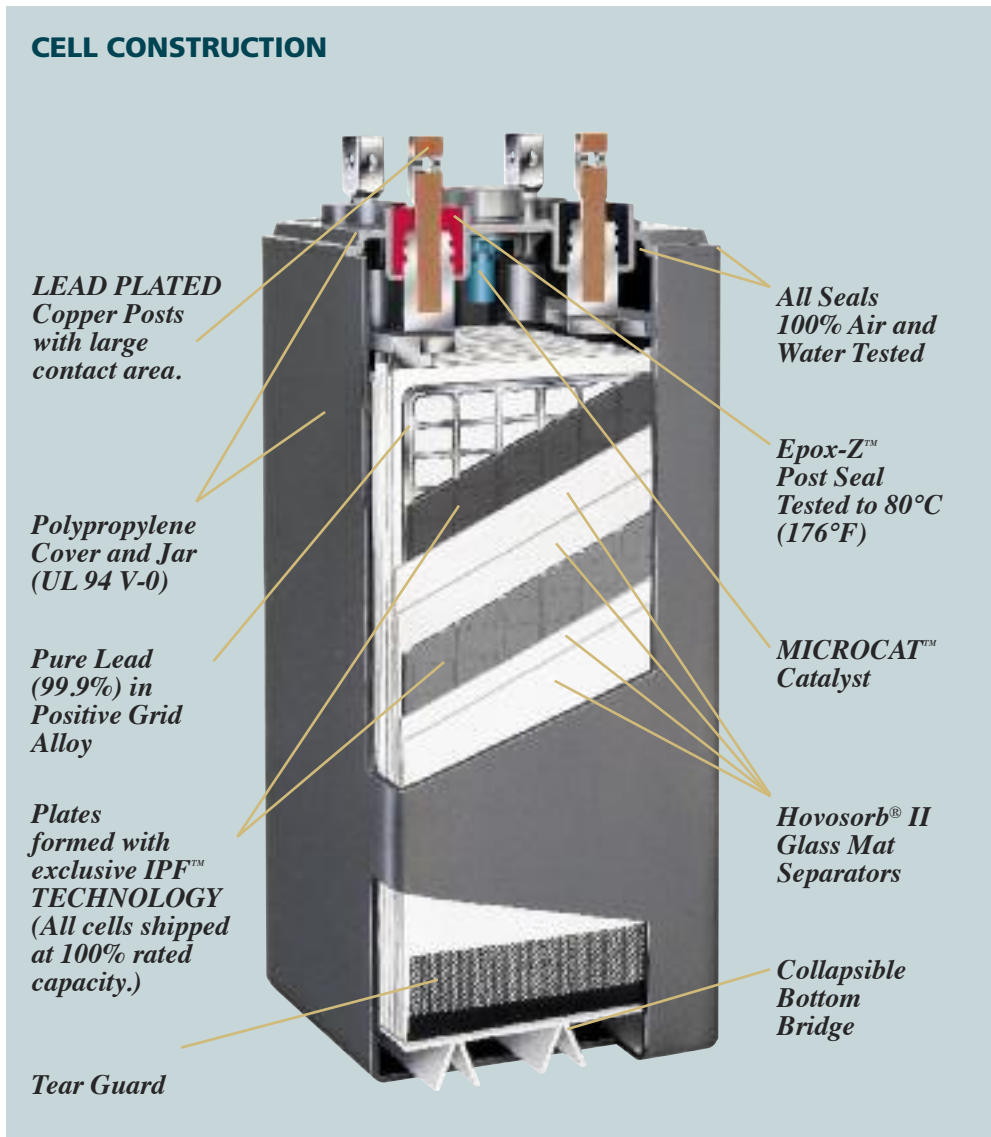
East Penn Manufacturing is on the forefront of the latest technology with its leading-edge VRLA/AGM (Absorbed Glass Mat) design. The company's extensive background with over 63 years of experience in the battery industry and over 23 years of manufacturing VRLA batteries support the company's advanced UPS battery product. Detailed workmanship, proven manufacturing processes, and the finest raw material resources results in batteries that deliver the industry's most reliable service for UPS applications.

Grid Casting

The internal supporting framework of the battery is called **grids**. Grids serve as a path for transferring electrical current. The positive grid contains a pure virgin lead (99.9%) and a low calcium and high tin alloy. The negative grid is also alloyed with a premium lead calcium 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 to ensure reliable performance and optimize battery design life.

Pasting

East Penn's active material, also referred to as "paste", is composed of a mixture of sulfuric acid, water, and a specially formulated lead oxide. East Penn's VRLA battery lead oxide is made with pure virgin lead (99.9%) and manufactured with a proprietary and exclusive formula 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.



teness. The paste is uniformly and automatically applied to the grid by computer-integrated pasting machines. 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 and charging process to guarantee perform-

ance, consistency, and a 100% capacity rating. 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 the plate is completely formed. IPF Technology provides precision temperature and voltage control, guaranteeing maxi-

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.

mum 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 use. East Penn's two-step process guarantees all Deka Unigy batteries ship at 100% capacity. This exclusive formation technique requires no equalizing charge saving the customer both time and money.

Other manufacturers form the fully assembled cell directly in the battery jar. This precludes 100% inspection of plate formation without complete cell destruction. This formation process creates 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.

Valve and MICROCAT™ Catalyst

Another unique advantage to Deka Unigy batteries is its exclusive valve. The valve is 100% tested for opening, closing, and back pressure. It releases pressure and quickly self-seals to prevent oxygen from entering the battery. East Penn's exclusive MICROCAT catalyst, built into the valve, assists the battery with the recombination process by lowering float current, decreasing internal temperatures, and decreasing the rate of dry out. A lower float voltage reduces the amount of energy necessary to keep batteries on float, which reduces the heat generated by the batteries. This saves costs by lowering the amount of cooling required for the battery room. Low

float voltage and low battery temperature also reduces plate corrosion further extending the battery's long-life performance and reliability.

Deka Unigy T4 Designed for UPS

The **Deka Unigy T4** is designed specifically to meet the needs of demanding UPS applications. The T4 produces **25% more power**, compared to East Penn's 2-volt telecommunication battery (model 125-33), through more top lead and a larger post surface area. The increased amount of top lead lowers internal resistance during discharge. This keeps the internal temperature of the battery cooler, reducing both plate corrosion and the additional costs related to battery room cooling. The enhanced post design allows for a quicker transfer of electrical current demanded by UPS systems. ■

TCO ANALYSIS: MAINTENANCE AND SAFETY

East Penn's VRLA batteries have the advantage

THE MAINTENANCE-FREE DESIGN ADVANTAGE

Specific Gravity and Electrolyte Checks

Deka Unigy VRLA: This sealed battery is **maintenance-free** design, requiring **no handling** of electrolyte or hydrometers. This prevents excessive labor and training costs associated with flooded products. A maintenance-free design also eliminates the potential for human error or damage when performing these critical checks that significantly affect the battery's performance and life.

Flooded: A flooded battery consists of a free flowing electrolyte. This requires periodic maintenance to check and maintain the specific gravity and electrolyte level of each cell. Should the electrolyte fall below the plate level, it would expose the negative plate to oxygen, which reduces the plate's capacity, and eventually decreases the capacity of the entire battery.

THE SAFETY ADVANTAGE

Spill Containment

Deka Unigy VRLA: Deka Unigy batteries have **no free flowing electrolyte** and the only spill containment requirement is a small wall mounted pack. The typical pack is usually as simple as a 10-15 gallon bucket with gloves, face shield, neutralizing solution, and

absorbent material which can all be disposed of in the bucket.

Flooded: When using a flooded battery in a UPS application, spill containment is a necessary requirement for the battery room. Regulations require that a 2" perimeter of valuable space exists around the entire battery module with surrounding absorbent pillows designed to soak up and neutralize the acid. These pillows are only required to handle 8 gallons of acid, which is the equivalent of the acid found in only one cell. A typical 1MW system has approximately 240 cells that contain 1,900 gallons of acid. Should something happen to even a few of the battery cells, the pillow's spill containment capabilities would soon be inadequate.

Ventilation

Deka Unigy VRLA: Deka Unigy batteries feature an **exclusive one-way pressure relief valves** to allow very small amounts of gas to vent to the atmosphere. Rooms with Deka Unigy batteries **require only standard office ventilation equipment** eliminating the need for expensive systems.

Flooded: Additional ventilation is an inconvenient requirement of flooded batteries in UPS applications. When a flooded battery is charged it generates oxygen at the positive plate and hydrogen at the negative plate. One hundred percent (100%) of these gasses are released into the atmosphere

through the battery vents. With flooded batteries, the battery room requires an elaborate hydrogen detection and evacuation system to disperse all of these gasses that are released into the environment. Should this ventilation system fail, it would contaminate air quality.

Exposure to Acid and High Voltage

Deka Unigy VRLA: Its maintenance-free design means that adding water is not required over the entire life of the battery. Voltage checks are done electronically and do not require the more manual and time consuming use of a hydrometer. A front terminal design prevents the user from having to reach over top of the battery around high voltage cables and contacts to perform routine maintenance checks. These aspects protect employees from harmful acid or unnecessary prolonged exposure to a high voltage environment.

Flooded: Scheduled maintenance to check and maintain the specific gravity and electrolyte level of each cell is required. Operators must reach over the top of the battery to open a vent cap and check the acid with a hydrometer and add water if the electrolyte level is low. Many stacked systems require an employee to use a ladder and reach over high voltage connections just to make routine checks. This is a potentially hazardous situation that can be avoided with a front access, sealed battery design. ■

TCO ANALYSIS: OPTIMIZING ESSENTIAL FACILITY SPACE

More power, Less space™

More Power

The more power compressed into a smaller space, the greater the benefit in UPS applications. The Deka Unigy product, especially the T4 design, clearly offers “More Power. Less Space.” The Deka Unigy T4 has a clear advantage over any flooded product on the market and outperforms flooded competitors by over 40% in watts/ft² and over 25% in watts/ft³ in significantly less space.

Deka unigy T4 Product Comparison

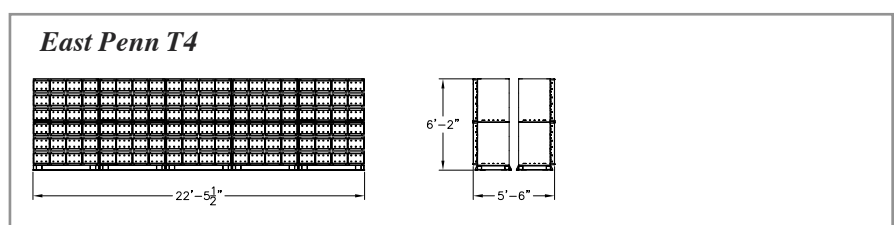
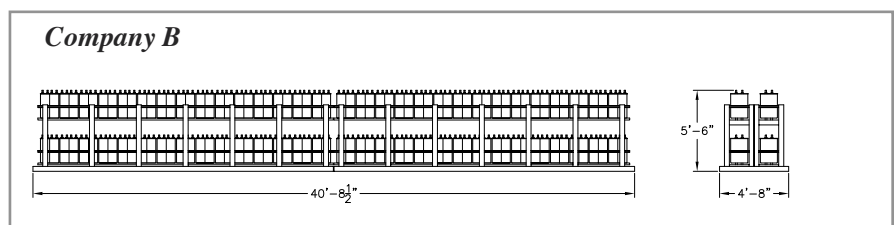
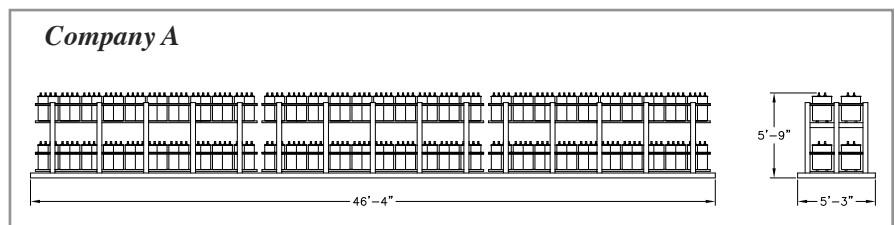
480 Volt Battery String Footprint Comparison 2 Volt AGM vs. 2 Volt Flooded

Product Type	Company	Product	Watts/ft ²	Watts/ft ³	Width	Depth	Height
2 Volt Flooded 2 Tier/2 Row	Company A	Product A	4009	708	45'	5'5"	5'8"
2 Volt Flooded 2 Tier/2 Row	Company B	Product B	5648	1027	42'	4'3"	5'6"
2 Volt AGM 6 high Back to Back	EPM	AVR4000 T4	7953	1289	22'6"	5'6"	6'2"

* Based on a 1 MW UPS system with a 15 minute runtime.

Less Space

A rapidly growing cost in the UPS market is the overall footprint or size of the space needed for battery systems. The footprint of the Deka Unigy T4 compared to flooded products on the market can save over 50% in space. Whether real estate costs are \$5 or \$500 per square foot, the savings are substantial. For example, if real estate costs are \$500 per square foot, the savings from the reduced amount of space of the Deka Unigy T4 would be \$168,000. ■



TCO ANALYSIS: Extended cost savings

Description	Flooded			Deka Unigy T4		
	Materials	Labor	Total	Materials	Labor	Total
INITIAL COSTS						
Real Estate Cost (@ \$500 / Square Foot) 3' Isles	504 sq. feet		\$252,000	276 sq. feet		\$138,000
Real Estate Cost (@ \$500 / Square Foot) Batteries	356 sq. feet		\$178,000	248 sq. feet		\$124,000
Battery Monitor Cost	\$24,626		\$24,626	\$67,026		\$67,026
Rack/Cabinet	\$25,680		\$25,680			
Hydrogen Detection System	\$1,500		\$1,500			
Hydrogen Evacuation System	\$2,500		\$7,500			
Spill containment system	\$19,512		\$19,512	\$150		
On Site Battery Installation		\$29,000	\$29,000		\$11,250	\$11,250
Monitor Installation		\$4,500	\$4,500		\$9,700	\$9,700
TOTAL INITIAL COSTS	\$69,818	\$33,500	\$542,318	\$67,176	\$20,950	\$350,126
ONGOING COSTS						
Preventative Maintenance (Annual-10 years)		\$11,600	\$116,000		\$2,400.00	\$24,000
TOTAL ONGOING COSTS		\$11,600	\$116,000		\$2,400.00	\$24,000
Number of years			10			10
Total Cost over lifetime			\$658,318			\$374,126
Cost per annum			\$65,832			\$37,413
DEKA UNIGY 10-YEAR SAVINGS = \$284,000						

While floor space and power density are critical, there are also many other related factors like the spill containment system, preventative maintenance cost, and potential cost of cell replacement that make up a Total Cost of Ownership analysis. When comparing the Deka Unigy T4 system to a flooded system, even when excluding initial battery costs, savings can reach thousands of dollars a year. Based on the example for a 1 MW system with redundancy (N+1), over a 10-year period, *the Deka Unigy T4 would provide savings over \$284,000.* ■

THE DEKA UNIGY T4

The Industry Solution for UPS Power

QUALITY & PERFORMANCE

- Plates formed with IPF™ technology to assure consistent cell to cell performance
- Case and cover heat sealed and 100% tested to prevent leaks
- Epoxy-sealed posts eliminate leaks
- Puncture resistant micro-porous glass mat separators extend life
- MICROCAT™ catalyst improves high temperature performance
- Computer-aided design and manufacturing control processes and standards to ensure quality products

REDUCED MAINTENANCE & ADDED SAFETY

- Front access design for easy installation and maintenance
- Maintenance-free batteries require no handling of electrolyte or hydrometers
- No elaborate spill containment or ventilation necessary
- Reduced risk to employees by eliminating potentially hazardous checks

MORE POWER, LESS SPACE™

- Advanced AGM technology for superior high rate, instantaneous power
- Outperforms flooded competitors by over 40% in watts/ft² and over 25% watts/foot³ in significantly less space
- Reduced floor space by as much as 50% with more power than any flooded product

VALUE & ASSURANCE

- Certified to UBC '97 - Zone 4 and IBC '06 - 300%
- All batteries ship at 100% of rated capacity
- Flame arresting, high pressure, self-sealing valves are 100% factory tested
- All batteries meet or exceed IEEE 1187 and 1188 requirements at shipment
- Product is supported by one of the industry's most reputable, quality-conscious, and innovative companies

With the highest quality performance, reduced maintenance, increased safety, more power in less space, and the best value in the industry, East Penn's Deka Unigy T4 product is the leading solution for UPS applications. Other systems may offer short-term savings but lower quality and additional expenses will end up costing much more in years to come. The Deka Unigy T4 combines the high quality performance critical to meet performance needs while providing a lower TCO, which even further increases the value of East Penn's advanced battery system. In a market-place where reliability matters the most, trust the Deka Unigy T4 to deliver superior performance for all UPS backup power system needs. ■

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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