



VYCON® Direct Connect (VDC®) Kinetic Energy Storage Systems

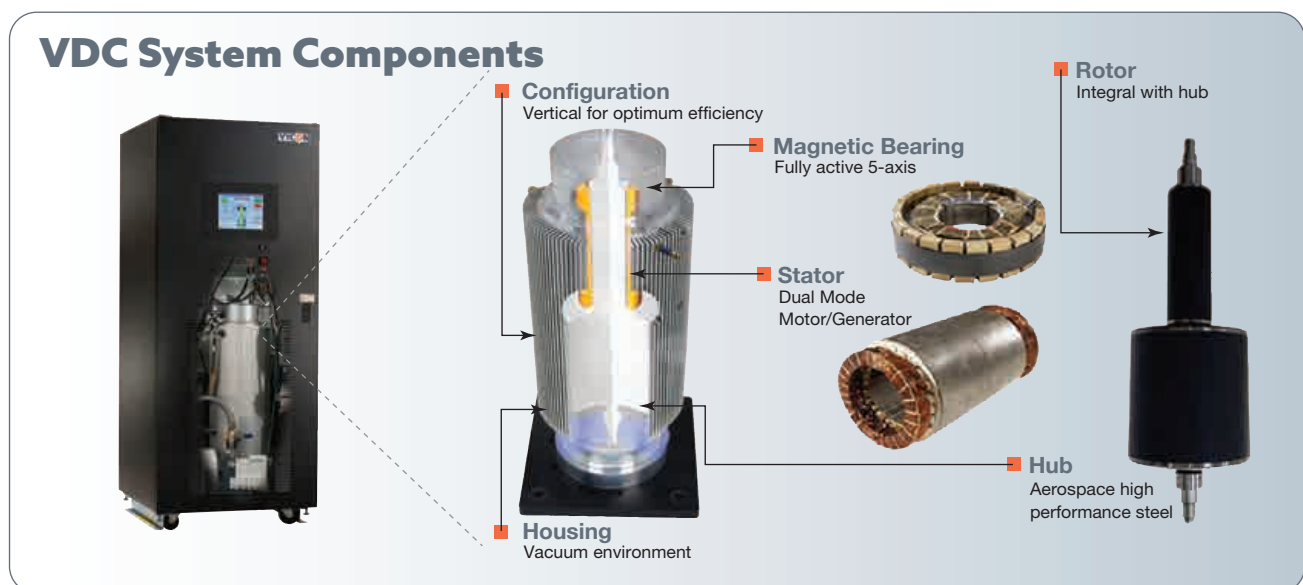
The Optimal UPS Energy Storage Solution for
Mission-Critical Power Protection



RELIABLE AND PREDICTABLE ENERGY STORAGE

The VYCON® kinetic energy storage system has been used in a variety of applications for many years. The VYCON system can replace traditional batteries and can perform in applications where batteries and other storage devices fall short.

The VYCON Direct Connect (VDC®) system stores kinetic energy in the form of a rotating mass and is designed for high power, short discharge applications. The patented technology within the VDC system includes a high-speed motor generator, active magnetic bearings that are used to levitate and sustain the rotor during operation, and a superior control system that can provide information on the system performance. These innovative technologies enable the VDC to charge and discharge at high rates for countless cycles making conventional technologies like batteries obsolete.



How VDC Systems Work

VDC kinetic energy storage systems work like a dynamic battery that stores energy by spinning a mass around an axis. Electrical input spins the flywheel hub up to speed, and a standby charge keeps it spinning 24 x 7 until it is called upon to release the stored energy. The amount of energy available and its duration is proportional to its mass and speed squared. For flywheels, doubling mass doubles energy capacity, but doubling rotational speed, quadruples energy capacity, thus giving VDC a significant competitive advantage.

Batteries Drain Resources

Batteries are the weakest link in the power infrastructure chain. While batteries may appear to be the most economical energy storage solution for UPS applications, they are a bigger drain on your resources than you think. And, even after spending time and money to...

- > Build and maintain a large, temperature controlled room to house them
- > Install lead acid spill containment and hydrogen gas monitoring
- > Obtain local fire code approvals
- > Install hardware and software to monitor them
- > Replace them regularly and dispose of their hazardous materials properly

...batteries still fail when called upon.



VYCON Systems Save Resources (Even Batteries)

If used in the place of batteries, VYCON systems save the time and costs associated with battery storage, maintenance and replacement.

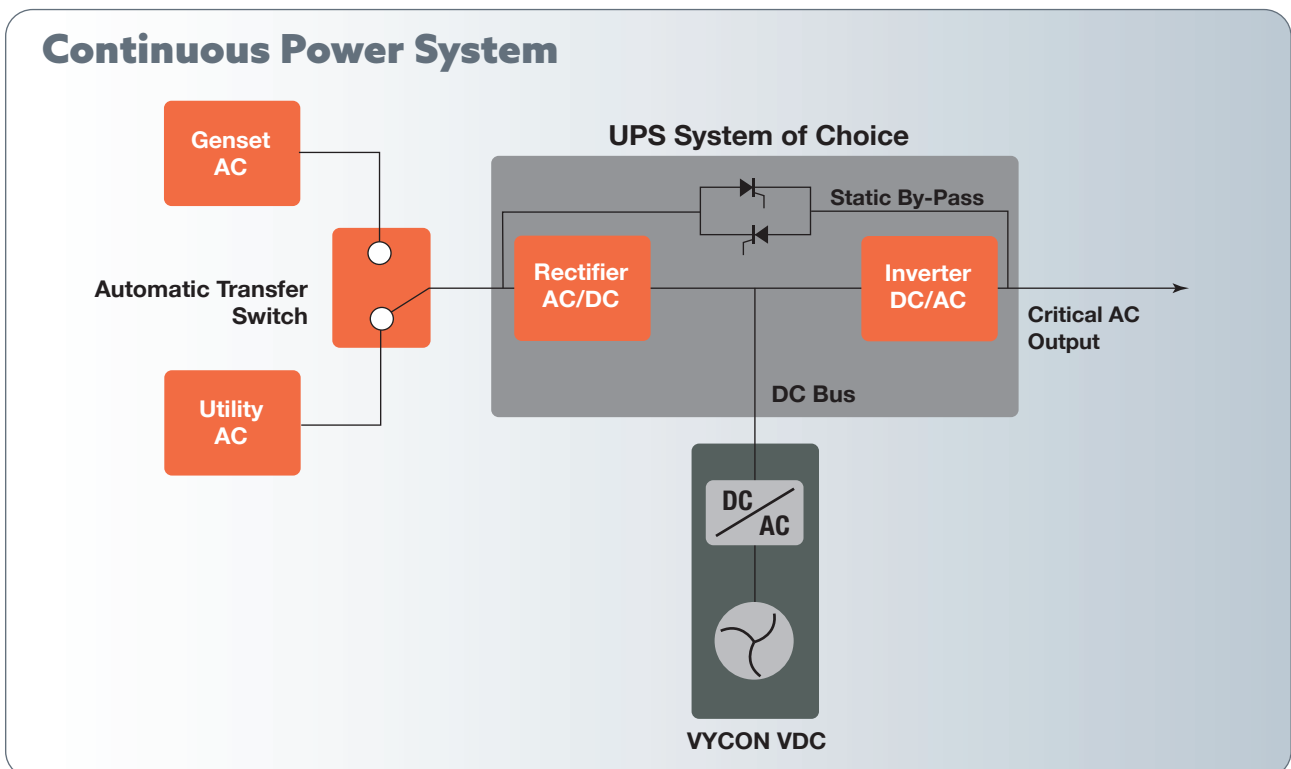
If used in parallel with batteries, the VYCON energy storage systems become the first line of defense against power anomalies – saving the batteries for prolonged power outages, thus significantly increasing battery life by absorbing over 98% of the discharges that would have normally caused the batteries to be cycled. High cycling is one of the main causes of premature battery end of life.

VDC Product Line

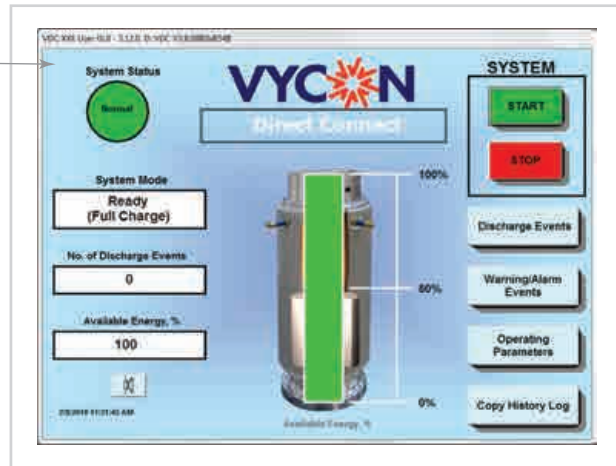
The Optimal Energy Storage Solution for Mission-critical Applications

Using patented kinetic energy storage, the VDC product line is the perfect solution for users needing a more reliable, cost-effective and greener approach to backup power in place of hazardous, lead-acid based batteries used in mission-critical applications.

Certified by most major brands of three-phase UPS's, the systems interface with the DC bus of the UPS just like a bank of batteries, receiving charging current from the UPS and providing DC current to the UPS inverter during discharge. Upon loss of utility power to the UPS, up to 450 kW of regulated DC power per VDC unit is instantly delivered to the UPS. This provides the backup power needed to start up and transition to the emergency generators during a prolonged utility outage. Multiple VDC systems can be paralleled for longer run times or N+1 redundancy (see runtime tables on page 5).



SELF-MONITORING OF VYCON® ENERGY STORAGE SYSTEMS PROVIDES UNPARALLELED AVAILABILITY WITH PREDICTIVE FAILURE ANALYSIS



What Makes VDC® Products Superior

- **High-speed permanent magnet motor generator**
 - > Highly efficient, compact and reliable
 - > High power density
 - > High temperature operation
 - > Fast recharge
- **Magnetic levitation system**
 - > No friction
 - > No lubrication
 - > No bearing replacement
 - > No maintenance
- **Smart monitoring system**
 - > Real-time monitoring of key parameters
 - > Advanced warning of any system faults
 - > Dry contacts and Modbus communication options
- **Go green and save**
 - > 3 to 4 year ROI
 - > Hundreds of thousands of dollars in savings when compared to using lead acid based batteries over 20-year operating period
- **Certified, tested and proven**
 - > Officially certified and tested by all major UPS manufacturers
 - > Supported by a network of over 200 trained technicians on 24 x 7 basis
 - > Over 900 systems deployed with over 13 million discharge/recharge cycles



Success Story Highlights

Texas Scottish Rite Hospital for Children (TSRHC)

Prior to incorporating VYCON flywheels, the TSRHC's MRI suite experienced power problems, causing the MRI system to completely shut down. "This can be especially problematic for patients when under anesthesia, as the child has to be awakened and the imaging rescheduled. This has happened at least twice before we installed the flywheel systems," said Tina Reese, Director of Radiology for TSRHC.

"We are pleased with the flywheels' performance. The green aspects of the flywheels were also of interest to us. Not having to deal with batteries was a plus. By incorporating flywheels as the energy storage part of the UPS, the hospital has saved time and money, but more importantly, is delivering predictable operation of our suite for our special little patients," said John Coté, TSRHC Engineering Department Director.

EasyStreet Data Center

We have two battery-based UPSs that we've had for almost 12 years. While the UPSs themselves have been reliable, we've experienced three failures of the batteries. We do preventative maintenance every quarter as the factory recommends, and still we weren't able to avoid battery failures," said Jon Crowhurst, Director of Technical Services for EasyStreet.

For EasyStreet, building a new data center meant looking at all green technologies available. The company has previously explored other flywheel solutions. "Having to replace the bearings in the other flywheel system is a relatively expensive maintenance operation and the unit is out of service for 6 to 8 hours," said Crowhurst.

Where other flywheel solutions cost nearly \$10,000 in bearing maintenance and replacement every few years, VYCON products do not require any bearing maintenance. EasyStreet selected VDC for its predictable, low maintenance technology. "The end stage is three UPSs with 18 flywheels total," said Crowhurst. "Reliability, sustainability and having a low carbon footprint are a part of the ethos of our company. This vision with actual energy savings allows us to save money, which translates to saving our customers money- it's a great win-win."

WDIQ Television Station

UPS systems have done well in mitigating power interruptions and conditioning "dirty" power, however broadcast engineers are finding that adding flywheels into the power continuity design significantly enhances reliability, increases green initiatives and lowers the total cost of UPS ownership.

"Since we installed the three-phase UPS along with VYCON's VDC flywheel, we have been completely protected against power outages, which we experienced here about twice a month," said Windell Wood, Director of Engineering for Alabama Public TV. "The flywheel system has operated flawlessly, and we're saving considerable money and resources by using a flywheel that requires no bearing replacement and has a 20 year life."

VDC-XXE AND VDC-XXT PRODUCTS AND SPECIFICATIONS

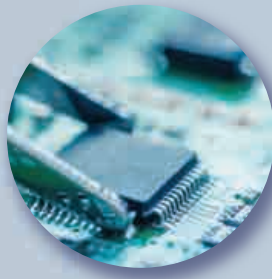
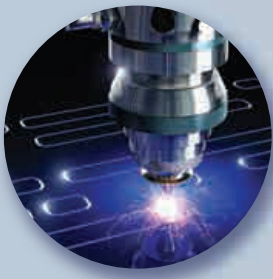
The VDC product line offers the flexibility to select the power level and run time combination that will meet your application requirements. From the tables below you can select the flywheel combinations that match up with your UPS and runtime requirements. The VDC products are compatible with most voltages and carry the UL, C-UL (Canada) and CE (Europe) marks. For special application requirements, please contact us at sales@vycon.com.

The VDC products are tested and approved for application on all major brands of UPS and VFD products, including ABB, Eaton (Powerware), GE, Mitsubishi, Riello, Schneider (MGE-APC), Socomec, Toshiba, and Vertiv (formerly Emerson Network Power).

Runtimes (In Seconds)*		UPS Output Power Rating (kVA)																			
Model: VDC XXE 540 V																					
NUMBER OF UNITS		40	60	80	100	120	160	225	250	275	300	400	500	550	600	750	800	825	1000	1100	
01																					
02		163	107	82	67	54	39	25	22	19	16										
03					160	127	105	80	57	51	46	42	28	21	18	15					
04						118	84	77	70	65	47	36	31	28	21	19	18				
05								99	90	83	64	50	45	41	30	28	27	21	18		
06										79	64	58	52	41	38	36	28	25			
												70	64	50	47	45	35	31			

Runtimes (In Seconds)*		UPS Output Power Rating (kVA)																			
Model: VDC XXT 540 V																					
NUMBER OF UNITS		40	60	80	100	120	160	225	250	275	300	400	500	550	600	750	800	825	1000	1100	
01																					
02		168	112	84	67	56	41	27	23	21	19	13									
03					165	132	109	82	58	52	48	43	30	23	21	19	14	13	12		
04						122	87	78	71	65	49	38	33	30	23	21	21	17	15		
05								103	94	86	64	51	47	42	32	30	28	23	20		
06										80	64	58	53	42	39	38	30	26			
												70	64	51	48	47	37	33			

*Backup times are typical using .9 Output Power Factor, 100% Full Load Rating, 96% UPS Inverter Efficiency and minimum 540 voltage bus setting.



Operating Parameters**

Power/Duration Ratings

Max Power	VDC XXE: 300kW VDC XXT: 450KW
Max Energy Storage	VDC XXE: 6000kW seconds VDC XXT: 6250kW seconds
Run Times	See tables on page 5
Flywheel Rotational Speed	36,750 to 14,000 RPM

Input

Input Voltage (Vdc)	400 - 600
Recharge Rate	15-50 Amps: Adjustable per application
Efficiency	99.4%

Output

Voltage Discharge (Vdc)	400 - 520 Adjustable per application
Voltage Regulation	+/- 1%
DC Ripple	Less than 2%
Operating Temperature	14°F to 104°F (-10°C to 40°C)
Humidity	90% non-condensing
Altitude	5,000 ft. (1524m) max without de-rating

Dimensions and Weight

Height	73.7 in. (1872mm)
Width	30.0 in. (762mm)
Depth	30.0 in. (762mm)
Weight	1,675 lbs. (760 kg) – 1810 lbs. (921 kg)

**Specifications subject to change

About VYCON® Technologies

VYCON is an innovator in the design and manufacture of technologically advanced flywheel energy storage systems that enable a highly reliable, cost-effective and clean energy storage solution for a variety of applications. VYCON products are applied in the power quality markets to provide back-up power in mission-critical applications and in the energy re-cycling markets for capturing and regenerating energy in electric rail, industrial and distributed generation applications. For more information, visit www.vyconenergy.com.



Seismic Certified (Shaker Table Tested)



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