

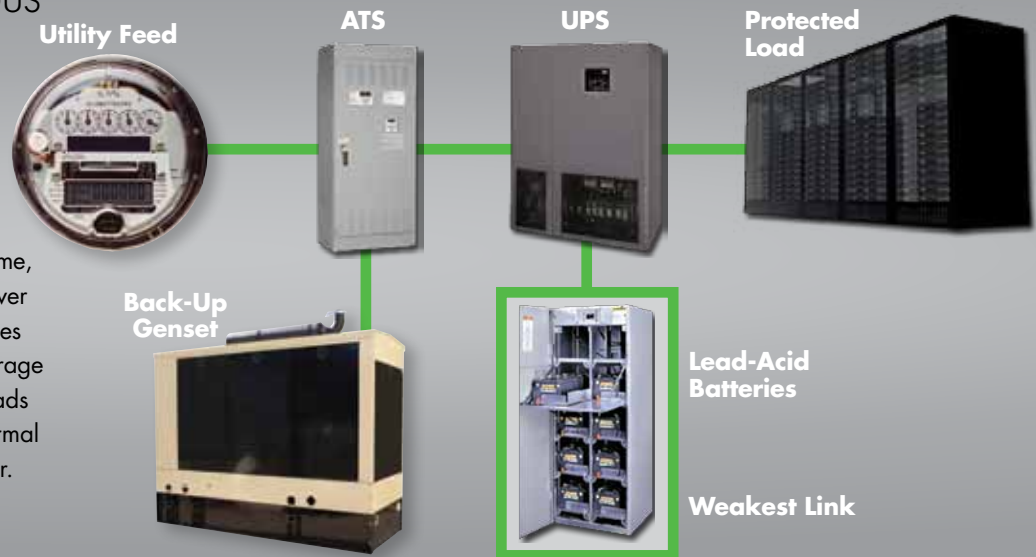


POWERTHRUTM
Clean Flywheel Energy Storage

THE BATTERY-FREE SOLUTION
FOR YOUR UPS SYSTEM

Typical Continuous Power Quality Solution

In a power outage, an automatic transfer switch (ATS) commands the back-up generator to start. During this time, the UPS ensures continuous power to the protected load via batteries or a flywheel. These energy storage devices power the protected loads until the utility line returns to normal or the back-up genset takes over.



POWERTRU designs, manufactures and markets advanced flywheel energy storage systems that provide ride-through power and voltage stabilization for power quality and power recycling applications. Designed to provide high-power output and energy storage in a compact, self-contained package, POWERTRU flywheel products are a long-lasting, low-maintenance, lightweight, and environmentally-sound alternative to flooded and valve regulated lead-acid (VRLA) batteries in uninterruptible power supply (UPS) systems.

The company shipped its first commercial production flywheel in 2004, and continues to provide award-winning flywheel products to critical applications around the world.

Batteries...the Weakest Link

Power quality and reliability systems need energy storage to ensure protected loads always receive clean power. However, any UPS operator will tell you that batteries are the weakest link in the power chain. Batteries:

- Fail unpredictably
- Require frequent and costly maintenance
- Need total replacement every 2-4 years
- Demand precise temperature control
- Generate a lot of heat
- Consume a large footprint
- Require a lot of reinforced floor space
- Endanger personnel with hazmats
- Damage the environment

There's a Better Way

More reliable and cost efficient, the POWERTRU flywheel energy storage system eliminates lead-acid battery hazards, maintenance, environmental impact and the "cross-your-fingers" approach to power certainty.

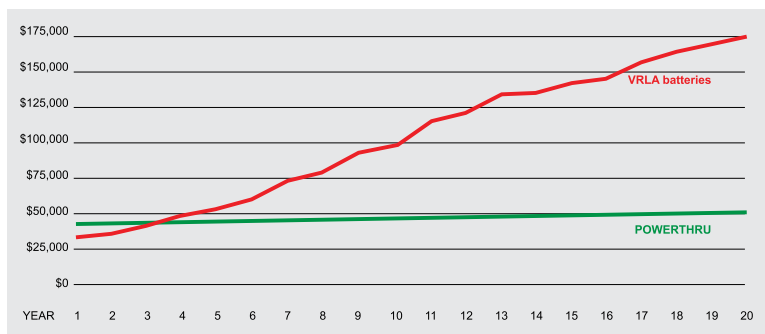
This carbon-fiber-flywheel technology connects with leading brands of UPS systems – just like a battery cabinet – but without the dangers, repetitive costs and poor reliability issues.

Bridging the Gap

Flywheels ensure continuous power by delivering the highest reliable UPS back up power during an outage. Flywheels provide the critical ride through time between the power outage and the generator coming online. What's more, flywheels provide continuous power during brief utility disturbances without impacting the capacity and expected lifetime of the flywheel.

Footprint Comparison

The floorspace needed by VRLA battery cabinets for a 400-kVA UPS – including code-maintenance access space – is nearly twice that of a similar capacity pair of flywheels (green). Compared to a one megawatt set of wet cells, the flywheel footprint is nearly 80% smaller (grey).



Flywheels cost more than VRLA batteries, but eliminate battery maintenance and string replacements, paying for themselves by shortly after what would be the first battery string replacement interval.

The POWERTHRU Patented Pump & Bearing-Free Flywheel

POWERTHRU flywheels use the inertia of a spinning mass to store and regenerate power. Here's how it works — a carbon fiber cylinder linked to a shaft with a motor-generator is fully magnetically levitated, spinning in a vacuum. In the event of an outage, the motor-generator uses inertia to create the energy needed by the UPS's DC bus.

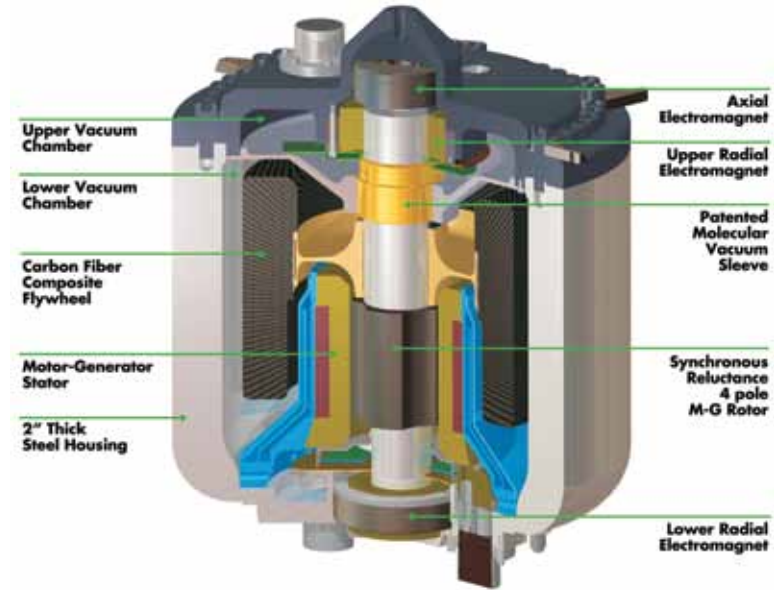
Eliminates Batteries All Together

Unless there is a need for energy storage redundancy, most facilities successfully use flywheels alone to achieve 10x or more reliability improvement without all the hazmats, costs and risks of battery banks.

Or Makes Batteries More Reliable

The POWERTHRU flywheel storage system can operate in parallel with batteries as the first line of defense against power quality disturbances.

During a power interruption, the UPS first draws current from the flywheel; the batteries are standing by until the flywheel is discharged, thus providing a smooth handoff for continued power. The flywheel delivers continuous power to ride through brief events (99% of all outages last <10 seconds, according to EPRI) or until the backup generator is online.



“Batteries are the primary field failure problem with UPS systems” Electric Power Research Institute (EPRI)

RELIABILITY

“10-yr” VRLA Batteries

Each cycle degrades reliability
Unknown state of charge
Recharge takes minutes/hours
Narrow temperature range
Frequent service & downtime
Dropped loads: <30k hours
Very low “float” energy needs
Expensive HVAC needs

POWERTHRU PT190

Unaffected by cycling
Always known state of charge
Symmetrical recharge (seconds)
Broad temperature range
Brief service every 2 years
Dropped loads: >350k hours
Even lower float energy needs
No HVAC needs

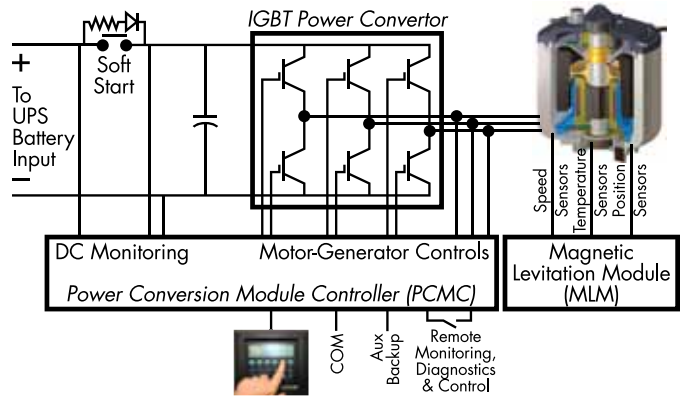
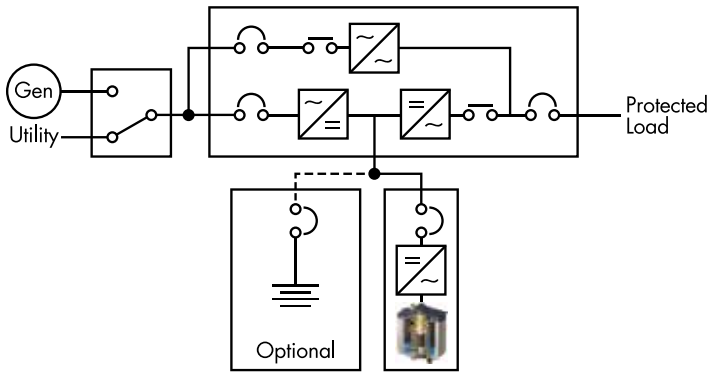
COSTS

Very frequent maintenance
Large footprint
Floor loading issues
Replacement every 2-4 years
Speculative monitoring option
Acid spills, dangerous gases

Very infrequent maintenance
Small footprint
No floor loading issues
>20-year design life
Built-in real-time monitoring
No hazmats, gases or fire risks

Key Features and Benefits

- Real-world proven: >10x the reliability of lead-acid batteries
- Vastly lower lifecycle costs than batteries and other flywheels
- An environmentally responsible solution to UPS energy storage
- 1/2 the footprint of VRLAs, and 1/4 the weight
- Runs near silently within a wide temperature range: no HVAC
- Low standby losses, highly efficient (99.6%): 1/10th of the losses of other flywheels
- No special flooring needs, rolls into place and installs in 1-2 hours.



RUNTIMES

Runtimes for UPS systems loaded at 50% and 80% (fractional seconds rounded down). Lightly loaded system can use fewer cabinets, then add more as load grows.

UPS Rating*	Flywheel Cabinets	50% Load Duration	80% Load Duration
1000 kVA	4	23 sec.	12 sec.
750 kVA	3	23 sec.	12 sec.
625 kVA	3	28 sec.	16 sec.
500 kVA	2	23 sec.	12 sec.
400 kVA	2	29 sec.	17 sec.
300 kVA	2	39 sec.	24 sec.
250 kVA	1	23 sec.	12 sec.
225 kVA	1	26 sec.	15 sec.
200 kVA	1	29 sec.	17 sec.
150 kVA	1	39 sec.	24 sec.
120 kVA	1	48 sec.	31 sec.
100 kVA	1	59 sec.	37 sec.
80 kVA	1	75 sec.	46 sec.

* Assumes a 540 Vdc bus, 0.9 pf and 95% inverter efficiency. Includes switchgear & cable losses; excludes rectifier walk-in.

SPECS

Continuous output power	190 kW nom., 225 kW max.
DC input/output voltage	Adjustable: 350 to 850*Vdc
Recharging time	<2 min. (DC source dependent)
DC ripple	<2%
DC output voltage regulation	±1 % steady state
Standby draw/heat dissipation	0.25 kW / 850 BTU/hr
Weight	1,300 pounds (590 kg)
Dimensions D x W x H	33x25x71 in (83x63x180 cm)
Operating sound level	45 dBA @ 1 meter
Operating temperature range	-4°F to 122°F (-20°C to 50°C)
Cabling access	Top or side
Service access	Only front access required

* UL-certification requirements have an upper limit of 600 Vdc



Made in the USA

Reliable UPS energy storage without all the maintenance and costs of lead-acid batteries

POWERTHRU[™]
Clean Flywheel Energy Storage

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