



POWER QUALITY AND PROTECTION SYSTEMS

Electric Power continuous power solutions



STARTING WITH A SOLID FOUNDATION

All Caterpillar power quality systems begin with the Cat UPS. The Cat UPS provides immediately available power to ride through disturbances and conditions power from the source. When integrated with other Caterpillar products – which include generator sets, automatic transfer switch (ATS) and switchgear – you can be assured of the cleanest, most reliable source of backup power protection.

Most importantly, the Cat UPS is backed by the solid Caterpillar reputation that comes from more than 75 years of building the best engines and power solutions available. Caterpillar engineers stay on the leading edge of power technology, and you can rely on Cat Dealers every step of the way. Caterpillar sets the standard for single-service support, from extensive parts inventory to preventive maintenance programs, diagnostics and emergency response service.

Cat UPS with Flywheel Technology

Power Protection Plus

Like other UPS systems, the Cat UPS works by storing enough energy to ride through power disturbances such as dips or surges in voltage and/or current. Match the UPS with a Cat generator set to provide long-term backup during an outage or extended power reliability situation.

What sets the Cat UPS apart is how the power is provided. The Cat UPS uses a highly power dense integrated flywheel to store energy. The stored power is immediately available for delivery to a critical load during a power disturbance. This system provides ample electricity to ride out disturbances or, when paired with a Cat generator set, to allow the engine to pick up the load for a longer backup period. The integrated flywheel design is modular, allowing for easy expansion to meet future power quality/power protection requirements.

In normal operation, the Cat UPS continuously conditions power from the utility and regulates incoming voltage while using a small amount of energy to keep the flywheel charged. This continues until the UPS senses a power fluctuation.

The flywheel then either supplies power to the critical load or consumes electricity from the stored supply to maintain consistent power to the connected load until normal conditions return. The Cat UPS system provides performance that is 97 percent efficient.



Energy is stored in a highly power-dense integrated flywheel, leveraging the kinetic power cell technology which eliminates the need for a string of batteries.



Easy-to-read LCD panel displays alarm warnings and system status.

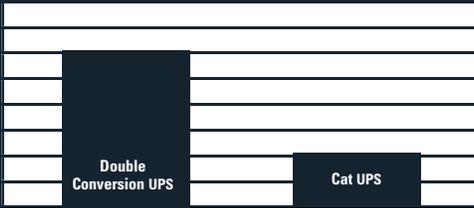
Cat UPS systems are available from 150kVA to multiple MVA.



COMPARING THE FACTS IN BLACK AND WHITE

	Cat UPS	Traditional Battery UPS
Size and Installation	Requires only 1/4 of the floor space of a static UPS system.	Large, bulky, space intensive. May require separate battery room, dedicated HVAC.
Maintenance	Requires only minimal upkeep and periodic air filter changes.	Frequent inspection, terminal cleaning, connection tightening, voltage measurement and more.
Reliability	Field-proven with over 9 million hours of operation.	Batteries are estimated to cause 70 percent of unpredictable failures in UPS systems.
Longevity	Nearly unlimited life with no fall-off in performance.	Batteries hold less charge with each use and need periodic replacement.
Energy Efficiency	97 percent efficient.	90 to 93 percent efficient.
Temperature	Broad operating temperature range up to 104°.	Requires special heating or cooling equipment to maintain specified temperature.

Formula: $\frac{\text{Energy Cost (1-eff.)}}{\text{Efficiency Percentage}} \times \text{Load} \times 8,760 = \text{Annual Energy Costs}$



Assumption: There are 8,760 hours in a year

On average, double conversion UPS units have operational costs that are up to three times those of the Cat UPS.

Manufacturing

Kodak Canada Inc.



Kodak Canada Inc. (KCI) in Toronto needed both an uninterruptible power supply (UPS) and power conditioning solution to ensure the continuous operation of its wide roll coating machine for the manufacture of inkjet photographic paper. The machine unwinds large stock rolls of paper and passes them through an applicator that coats the paper according to product requirements, after which the coated paper is dried and rewound into finished stock rolls. As the continuous, high-speed nature of the machine's operation is critical, a power interruption could create significant product damage and maintenance downtime. KCI thus felt it necessary to install a UPS that would protect the machine from the effects of unclean power, ensuring continuous machine operation (i.e., product conveyance and liquid flow to the coating applicator) despite dips and sags in the power supply. In addition, KCI felt it important that a UPS with sufficient energy storage be in place to provide ride-through in the event of a complete power outage.

To address KCI's concerns related to power quality issues, Caterpillar proposed installation of a Cat UPS 300kVA unit that would replace a smaller existing unit and deliver sufficient energy to handle both current and future loads in KCI's film processing plant.

Upon installation of the Cat UPS unit, KCI experienced immediate results in power conditioning. "We've had a number of power interruptions since the unit's installation, and it has worked perfectly," stated John Marcinkowski, Technical Associate, KCI. "Our power monitoring clearly indicates disturbances in the initial power supply from the utility, yet trends at the output of the Cat UPS have shown no disturbances to the process supply to date. Wherever there are critical processes, we are now able to provide that machinery with the necessary and reliable protection against power loss."

CUSTOMER SUCCESS STORIES

Medical

St. Elisabeth Hospital, Belgium



To accommodate an expanding population, St. Elisabeth Hospital in Turnhout, Belgium, underwent a major renovation and expansion of its facilities. The construction included an entirely new wing housing six operating rooms, an industrial kitchen, a sterilization room and a pharmacy. Subsequently the hospital required redesign of its existing power conditioning and backup power system to provide additional protection from failures, micro and macro outages, voltage sags and surges, and utility harmonics pollution -- all of which could detrimentally affect the function of critical medical equipment. The hospital also wanted to install an uninterruptible power supply (UPS) that would provide both permanent voltage conditioning and higher-performing active harmonics cancellation than that being delivered by its existing UPS.

To deliver the required 1620kVA of power support for the recent expansion and anticipated growth,

both a Cat 3508B diesel generator set and a four-wire, 50HZ Cat UPS 1000kVA were specified. The Cat UPS and generator set are connected by a custom designed 1600A motorized transfer switch. Equipped with a generator set start-up option, the Cat UPS will be able to feed a 24VDC current to the generator set's electrical starters. This feature, in addition to the UPS' battery-free flywheel energy source design, significantly decreases the likelihood of generator set start-up failure, which is of critical importance in a hospital setting.

A new power distribution network design feeds all areas of the hospital into the UPS, with the flexibility to remove less critical areas once the 1000kVA capacity is reached. This type of design enables the unit to maintain an optimal operational condition, provide critical power users with permanent and clean voltage at their disposal, and facilitate continuous power factor improvement at the input of the UPS.

Making a Perfect Match

Compatibility between UPS systems and standby generator sets can be challenging due to the inconsistency of UPS filters and power electronics. Caterpillar has solved these issues by designing the UPS to work with the generator set from the start. Coupling the Cat UPS with a generator set ensures proper sizing and synchronization. Line noise and generator heating are also less of an issue because the contributed total harmonic distortion is limited to less than 4 percent. In the event of a full kinetic power discharge, the flywheel can be recharged to 100 percent of energy capacity in less than 2.5 minutes.

Lowering Life Cycle Costs

One of the Cat UPS system's biggest advantages is its lower operating costs over the life of the unit. The Caterpillar system offers less than half the life cycle cost of any battery-based unit. Contributing factors include:

- Lower maintenance/replacement costs
- More efficient management of maintenance resources
- Space savings of up to 75 percent. Small footprint with no added floor space required for HVAC, temperature control or ventilation equipment
- Higher system efficiency and reliability
- Yearly energy efficiency improvement of 4%, resulting in thousands of dollars in savings



Match the Cat UPS with a Cat generator set to provide long-term backup during an outage or extended power reliability situation.



PROTECTING THE ENVIRONMENT

By eliminating batteries from the UPS, Caterpillar has created a power quality solution that poses no safety hazards to personnel or the environment. There are no toxic chemicals needed for its operation, no material

disposal concerns and no special HVAC or ventilation requirements to address the buildup of heat or harmful/volatile fumes that can be associated with lead acid batteries.



TOTAL SYSTEM INTEGRATION MADE EASY

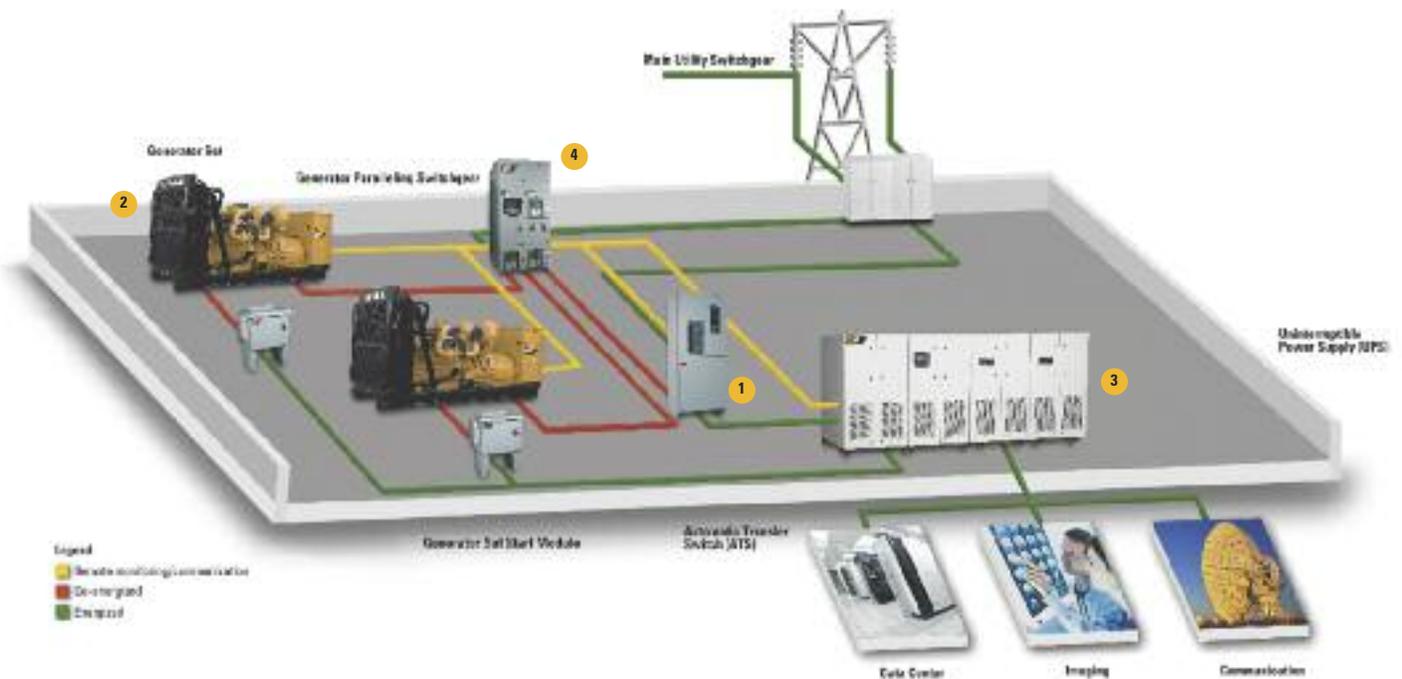
All Caterpillar products are designed to work together, with all elements relating to the generator set production, control and monitoring function integrated into a single-source package.

Plus you'll have the benefit of a single source for parts and service. Your local Cat Dealer is always available to provide the support you need, from system design to long-term maintenance.



- 1 **Cat Automatic Transfer Switch (ATS)*** – Caterpillar offers a broad range of ATS products, with digital microprocessor controls, to suit any application – from a single-ATS installation to a complex multi-ATS/generator switchgear system. Both open and closed transition designs are available with optional bypass/isolation and delay features in sizes from 40 to 4,000 amps.
- 2 **Cat Generator Sets*** – Available in both gaseous and diesel, Cat generator sets are known for delivering consistently reliable performance in any conditions. Cat diesel engines are designed with high-strength blocks, large bearing areas, steel-backed aluminum alloy bearings and hardened crankshafts to provide thousands of hours of backup power without overhaul. Cat gas generator sets are fuel efficient and offer many of the same durable components found in their diesel counterparts. They feature a patented electronic ignition system and detonation-sensitive timing that effectively controls emissions. In addition, electric power systems, ranging from 7 to 2,250kW, provide reliable, continuous backup power.
- 3 **Cat Uninterruptible Power Supply (UPS)** – Continuously conditions power and regulates voltage from the source and provides ride-through power to bring the generator set online.
- 4 **Generator Paralleling Switchgear** – Creates seamless integration of UPS and generator set.

* Caterpillar offers both UL and IEC approved products.





Caterpillar: Your Single Source for Clean, Continuous Power

With a Caterpillar continuous power solution, you can protect your critical operations with a full range of power quality and power protection systems. From gaseous fuel and diesel-powered generator sets to the Cat® Uninterruptible Power Supply (UPS), Caterpillar has everything you need to maintain clean, continuous power for your business operations.

Power Protection Systems

Business applications that benefit from Caterpillar® power protection systems include:

- Continuous process manufacturing such as plastics, chemicals and pharmaceuticals
- Information technology providers including data centers, call centers and broadcast companies
- Critical services including hospitals and emergency response systems
- Government entities including schools and universities, mass transit systems and public utilities
- Financial and retail operations such as banks, insurance groups and department stores
- Companies that would suffer operationally, financially or legally from a power disturbance of any length of time

Power Quality Systems

But continuous power isn't the only issue when it comes to electrical supply. Even when the electricity is on, the quality of the power can be compromised. Dips, sags and surges create an unstable flow of electricity that can be just as damaging as a complete outage – if not more so – making a clean power supply an equally critical priority. The most common sources of power quality issues are natural causes such as weather, technological issues involving equipment or wiring malfunctions and human error. These issues can create a myriad of problems, including:

- Loss of critical data
- Dropped sales or service calls
- Damage to manufacturing equipment
- Loss of product or a batch of materials
- Environmental safety risks
- Legal liabilities resulting from service lapses



Systematically Providing Power Quality Solutions

By implementing a continuous power solution, you can avoid power quality problems. Your Cat Dealer, and Caterpillar team offer systems tailored to your specific application. Caterpillar product support capabilities include:

- **System Concept Development** – The Caterpillar team helps you determine the right configuration for your power quality and protection requirements.
- **Project Management** – From financing to execution timetables, your Cat Dealer works with you to develop a step-by-step plan that meets your unique needs.
- **Maintenance** – Your Cat Dealer provides single-source, end-to-end service for all your Caterpillar products.
- **Site Installation** – From commissioning to training, your Cat Dealer can manage the entire installation process, staying on the job site until everything is just right.
- **Commissioning and Performance Verification** – Your Cat Dealer can test, monitor, and verify your system's performance throughout its life.
- **Emergency Response** – Unmatched product knowledge and service experience are available to you any time, day or night, through your Cat Dealer.
- **Engineering Services** – Cat Dealers and their engineering partners can be involved every step of the way, ensuring that the equipment design and configuration match your application properly.



Providing Continuous Support

At Caterpillar, the relationship doesn't end when the sale is final. In fact, it's just the beginning. From delivery to product support, Caterpillar is with you for the long haul. As a Caterpillar customer, you'll be on the receiving end of Caterpillar experience and legendary customer service, which includes:

- Financing solutions
- Maintenance and support
- Logistics
- Equipment insurance
- Training
- Capital management
- Rental

Caterpillar. Your Local Resource Worldwide Network.

Your Cat Dealer is prepared to answer any questions you may have about Cat Power Systems, customer support, parts or service capability anywhere in the world. For the name and number of the Cat Dealer nearest you, visit www.catups.com and click on the dealer locator.

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