



PILLER

Power Systems



UNIBLOCK™ UBT+
Rotary UPS

Nothing protects quite like Piller

piller.com

UNIBLOCK™ UBT+



Piller headquarters, Osterode, Germany

About Piller

Founded in Hamburg, Germany over 100 years ago by Anton Piller, the company has a long history in the manufacturing of exceptionally high quality electrical machines and power quality equipment. Today, Piller is a world leader and innovator in a number of power protection technologies, specialising in UPS systems for 'mission critical' applications and Frequency Converters for Aircraft Ground Power amongst other uses. For the past 30 years, the company has designed and manufactured static technology products alongside their rotary counterparts, giving it a unique position in today's power protection market.

Piller UPS systems are found in applications where continuous high quality power is paramount such as computer data centres, financial institutions, broadcasting, telecommunication networks, airports, healthcare facilities and continuous process production sites.

Piller Frequency Converters and related products are widespread in both military and civil applications providing 400Hz ground power systems to airports, ship-to-shore supplies in ports and on-board power systems for both submarine and surface vessels.

Since 1919, Osterode in Germany has been the home of Piller Research, Development and Manufacturing and a source of pride where all products can be seen in manufacture, from raw material through to finished goods. In 2016 Piller Power Systems Inc., the US subsidiary of Piller Group GmbH, acquired the business and assets of Active Power Inc., a US kinetic energy storage specialist. Piller Group GmbH is a division of the UK based engineering and industrial group, Langley Holdings PLC. (www.langleyholdings.com).

Power around the clock, around the world

Today's industrial world is changing and growing at a faster pace than at any other time in history. This development depends heavily on modern communication infrastructure, energy efficient solutions and continuous quality power. In striving to meet the demand and remain competitive, processes have become ever more automated, communications more sophisticated and data transactions even faster. That means it is necessary for reliable, continuous, energy efficient power to be at the very heart of our modern global economy: Piller UPS systems are designed to fulfil that mandate.

The ideal UPS must be highly reliable, efficient, adaptable and able to cope comfortably with any load profile, system configuration or ride-through

requirement. The new Piller UNIBLOCK™ UBT+ family is exactly that kind of UPS, combining state of the art machine technology and electronics to deliver outstanding reliability, efficiency, flexibility and performance.

Introducing the UNIBLOCK™ UBT+

The UBT+ is unlike any other UPS. Consisting of a special combination of proprietary motor-generator and choke, this UPS provides a very simple and highly reliable uninterruptible power solution with exceptionally high efficiencies. The technology employed provides an extremely robust, small foot print, high power solution designed to give over 20 years of dependable operation. The UBT+ can be employed in both normal and harsh environments, with any type of load and for any single system power up to 40MW. With the UNIBLOCK™ UBT+, multiple system configurations are readily possible. Paralleling is simple, modular expansion easy and there are unit power ratings for even the biggest of installations.

UBT+ can be configured for:

- Long and short term bridging applications
- Standby generation and Cogeneration
- Containerised solutions

Mission critical power

Principle of Operation

In a Piller UBT+, power is normally conditioned through the coupling choke, with the motor-generator (MG) continuously operating. The MG set, acting as a rotating transformer has four primary functions: In normal operation, it serves to provide a charging path for the ride-through source, which can be either batteries or a POWERBRIDGE™ kinetic energy store. It also provides reactive power to the load so that the UPS input is at near unity power factor without the need for unreliable power capacitors. In fact, power capacitors are eliminated from the UPS altogether.

In emergency mode, the power flow instantly reverses through the MG set and the ride-through source provides the active power to the load. The MG set continues to provide the reactive power and now also becomes the sole source of current for load-side fault clearing, avoiding the need for any reliance on bypass operation.

All of this power flow management is handled through the coupling choke which in turn allows for a very wide input voltage deviation whilst maintaining narrow tolerances at the output.

The UNIBLOCK™ Motor-Generator

At the heart of every Piller rotary UPS lies the pre-eminent UNIBLOCK™ synchronous motor-generator with its unique low-distortion, high fault-clearing characteristics. Inside the UNIBLOCK™ machine, motor and generator windings share a common stator and a single brushless rotor provides a highly compact double winding machine with special electrical characteristics. The combination of special electric steel and combined stator windings gives rise to a machine with exceptional efficiency whilst delivering the sub-transient reactance required for low harmonic distortion and high fault clearing capacity. A damper cage is incorporated to reduce harmonics and the simple bearing design offers high reliability and maintainability. The machine is manufactured and balanced at the Piller factory to ensure extremely long service life. A further feature is added by mounting the machine vertically which dramatically reduces the footprint of the UPS.

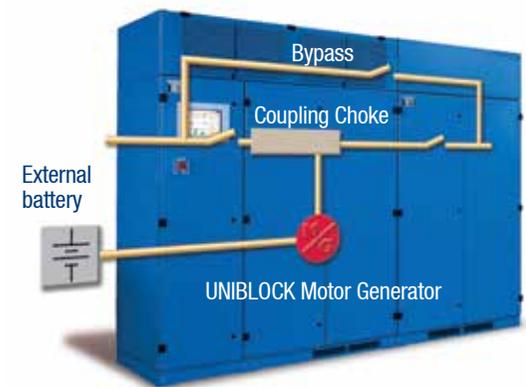
System Reliability

A design free of power capacitors eliminates the highest failure component generally found in other UPS. The durable rotary machine technology is far less sensitive to damage from overload and other electrical disturbances and uses no brushes, slip rings or complex bearing arrangements. The power electronics employ rugged semi-conductor technology with no need for internal paralleling or

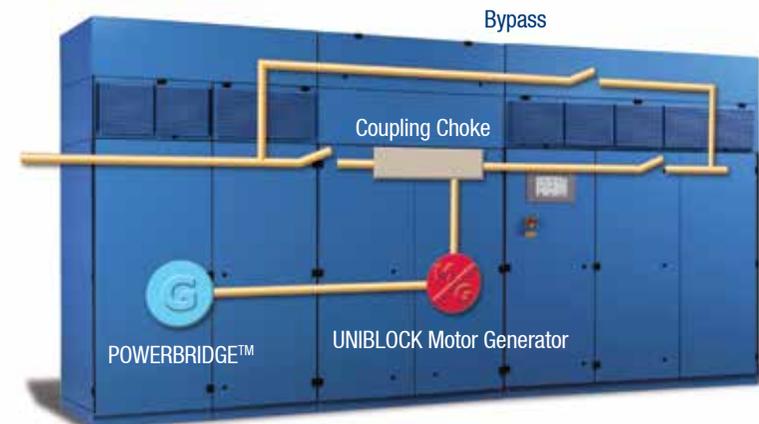
multiple power capacitors and bypass operation is not required for any aspect of the UPS function. Electric cooling fans are eliminated by using the impeller of the UNIBLOCK™ machine for the system cooling. All of these factors combine to provide a UPS which exhibits a level of reliability that cannot be matched by other technologies.

Power Quality Improvement

The UBT+ will compensate without disconnection from the supply for very low input voltages, including voltage sags to 50% of nominal and can protect against brownouts to -30% without even using the stored energy. The unit easily handles 100% non-linear loads as well as 100% step loads whilst maintaining a stable output. Acting as a bi-directional filter inside the UPS, the choke eliminates the passage of practically all harmonics between load and source.



UBT+ with external battery ride-through.



UBT+ with POWERBRIDGE™ kinetic energy store.

UNIBLOCK™ UBT+

UNIBLOCK™ UBT+ features

- Single machines sizes from 500kW up to 2700kW
- Paralleling up to 40MW
- Higher reliability than other technologies
- Highest efficiency, up to 97% with energy store connected
- Automatic redundancy power management
- Total design flexibility
- Medium and low voltage options
- Battery or flywheel-backed versions
- 3 times longer bridging time from Piller POWERBRIDGE™
- Fastest kinetic energy recharge time with POWERBRIDGE™
- Wide leading and lagging load power factor without de-rating
- Inherent fault clearing ability for downstream short circuits
- Virtual unity input power factor
- 99% input/output harmonic isolation
- Small footprint and high power density
- Simple maintenance requirements

Power Factor Correction

Power factor correction is natural with the UBT+. The MG and choke combination compensates for poor power factor loads so that the utility sees near unity across all load levels. That means no electricity tariff penalties need apply, no power factor correction units are needed and any standby generators can be sized like-for-like with the UPS.

Fault Handling

The UBT+ is inherently capable of clearing short circuit faults by virtue of extremely low sub-transient reactance that approximates towards normal supply transformer impedances. This means that the fault-clearing current can be generated internally by the UPS without the presence of a utility or even a standby-generator source. This capability represents a step improvement in fault tolerance of the power system when compared for example, with any static UPS solution.

Simple Maintenance

Nothing in the UBT+ design requires off-site overhaul and the maintenance requirements are less than most alternative topologies, having no power capacitors or electric fans to be changed. Life expectancy of the UBT+ easily exceeds 20 years.

- 
- System fan
 - Thrust bearing
 - Brushless excitation
 - Motor and generator winding in a common stator
 - Common rotor with damper winding
 - Vertical machine with minimum footprint
 - Pony motor
 - Unloaded guide bearing

Unparalleled reliability

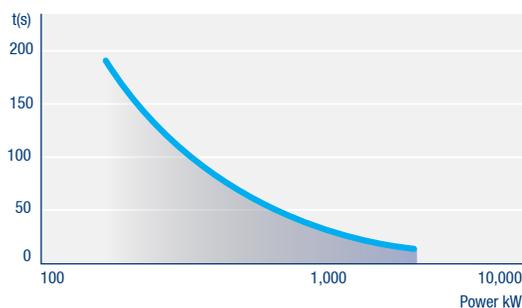
POWERBRIDGE™ Advantages and Benefits

- **Floor Space** Up to 90% can be saved when compared to batteries
- **Temperature range** A wide environmental specification means that air conditioning is not required
- **Maintenance efforts** Bearings are greased automatically from a reservoir
- **Life time** > 20 years
- **Reliability** A simple electrical machine with known energy content
- **Safety and environment** The unit operates in an inert environment and there are no special handling requirements
- **Energy** POWERBRIDGE™ is capable of storing more energy than any other kinetic storage system for UPS applications

POWERBRIDGE™ Option

Piller offers a kinetic energy storage option which gives the designer the chance to save space and maximise power density per unit. With a POWERBRIDGE™, stored energy levels are certain and there is no environmental disposal issue to manage in the future. Importantly, a POWERBRIDGE™ will absorb energy at the same rate as it can dissipate. That means the POWERBRIDGE™ can stabilise a diesel engine and that frequency stability under dynamic load conditions cannot be matched by any other kinetic storage solution. A vertically mounted flywheel and generator utilising magnetic bearing technology, the POWERBRIDGE™ is available in a number of sizes for different power ratings and ride-through autonomy.

The POWERBRIDGE™ works by storing energy in a flywheel whose shaft is common with the rotor of a synchronous generator. When stored energy is needed, it is discharged through the generator into a converter stage that ensures a stable frequency and voltage into the UNIBLOCK™ motor-generator. Recharge works similarly in the opposite direction. The efficiency is made extremely high by employing magnetic-lift bearing technology to significantly reduce forces on the main bearings. This also serves to extend the bearing life to many years of continuous operation.



POWERBRIDGE™ Ride-through energy.

- Top bearing
- Brushless excitation
- Main machine
- Flywheel
- Bottom bearing





UNIBLOCK™ UBT+ options

UNIBLOCK™ UBT+ Water-Cooled Option

The UBT+ is typically naturally cooled by using the UNIBLOCK™ impeller to duct the warm air straight to the outside world. When site restrictions make this impossible, other cooling methods must be employed and the plant room can either be force-cooled or alternatively, the UBT+ can be provided with its own heat exchanger directly connected to the building's chilled water supply. In this configuration, each UBT+ unit now has a closed air cooling circuit that passes via a heat exchanger cabinet integrated at the end of the UPS. An integrated cooling unit provides the UPS with its own climate. Hence, the UPS can then be operated in small rooms, in

aggressive environments or in areas where quiet operation is required. Without the need for external forced cooling, complex plant room airflow studies can be eliminated, space can be saved and maintenance routines simplified.

UNIBLOCK™ UBT+ Containerised

The Piller UNIBLOCK™ UBT+ UPS can be installed in a plant room or supplied complete from the factory as a containerised unit. All components necessary for operation are integrated into the container making the Piller UNIBLOCK™ UBT+ a transportable UPS system ready to set to work in a variety of locations or when a project programme better suits off-site construction.



Water-cooled benefits:

- Higher efficiency in the plant room
- Capable of operation in harsh environments
- Reduced investment costs
- Lower operating costs
- One service partner
- Smaller space requirement
- Extremely quiet operation

Containerised benefits:

- Operating readiness immediately on connecting to the mains
- No structural measures for noise attenuation, ventilation or cabling
- Minimal expenditure for on-site testing and commissioning
- No outlay on complex installation or plant room construction
- Temporary use in different locations or use in modular expansion
- Reduced on site programmes

Unequalled efficiency

Cross section of water-cooled unit

- A:** The enclosed air circuit is operated by an internal fan impeller incorporated in the rotor of the UNIBLOCK™
- B:** The UNIBLOCK™ UBT+ with built-in water cooling is connected to the chilled water circuit of the building

Highest Efficiency

The losses of any UPS have a direct effect on the electricity consumption within a building but as these losses rise, the cost of associated cooling measures rise, too. Therefore, a UPS with very low losses that can also be naturally cooled, offers the best operating economics under all circumstances. With an efficiency of up to 97% at full load, remaining very high even at partial loads, the UBT+ sets new standards in the UPS sector.

Automated Power Management

With the UNIBLOCK™ UBT+ the number of active units in a parallel system can be automatically adjusted to suit the load. When this feature is activated, the number of running units is automatically optimised to the prevailing load level whilst maintaining the redundancy level required. This means that when load levels are below design capacity, the load on each active unit can be increased resulting in an increase in efficiency of the system as a whole. The intelligence of the power management system is such that operating hours for all units are levelled over time ensuring that the same units are not permanently idle in prolonged low-load situations.

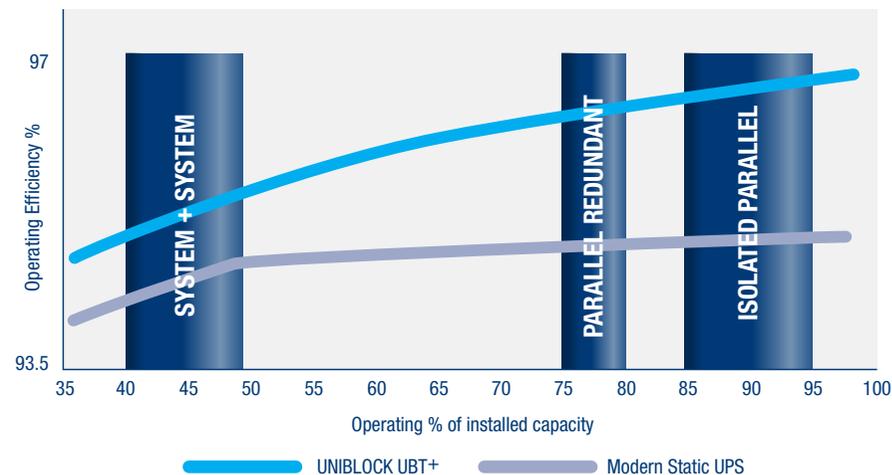
Example:

In a 2MW Data Centre with an installed UPS capacity of 5 x 500kW (N+1 redundancy), and an actual load of 900kW the savings are:

- 2 of 5 units stopped by load control
- UPS load for remaining units increased from 36 % to 60 %
- Efficiency improved from 94.6 % to 96.2 %
- Losses reduced by 140,000kWh per year
- Yearly emission of 83t CO₂ avoided



UBT+ improves efficiency in all configurations.





UNIBLOCK™ UBT+ configurations

Any configuration is easily realised:

- Hot standby redundant
- Parallel power
- Parallel redundant
- Isolated redundant
- Isolated parallel
- System + system redundant
- Common or individual bypass

The UNIBLOCK™ UBT+

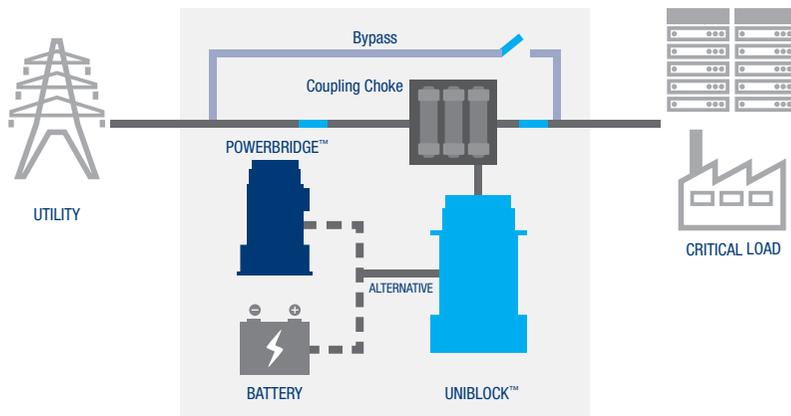
The UNIBLOCK™ UBT+ is a self-contained UPS that can be operated independently. By itself, the UBT+ will provide UPS power according to battery or POWERBRIDGE™ autonomy, stabilising voltage swings, riding through brown-outs and frequency dips, correcting power factor and suppressing harmonics. Research shows that, in most utility supplies, mains disturbances lasting more than 10ms occur almost daily, jeopardising or substantially disrupting the operation of electrical equipment. In a typical overhead grid system, over 60% of all mains failures last more than 100 ms and yet only some 2% continue for more than a few seconds. The unique design of the Piller UNIBLOCK™ UBT+ gives sufficient ride-through capability for the

vast majority of outages regardless of the ride through option and using batteries provides a mechanism whereby complete utility failure up to 30 minutes is easily managed.

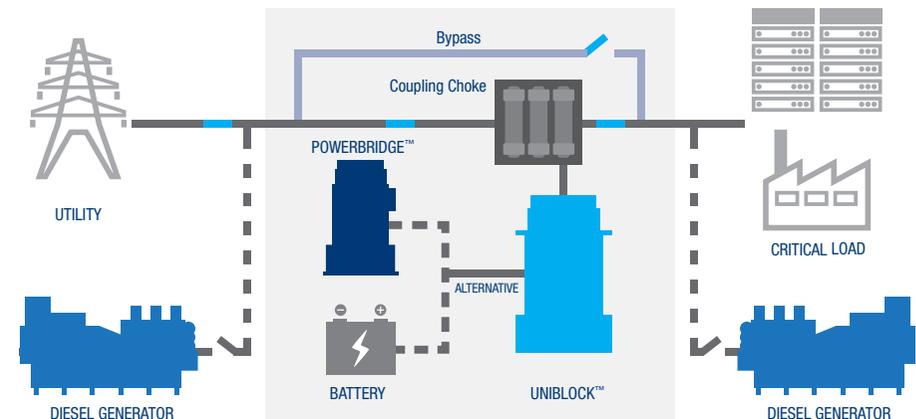
The UBT+ with Standby Generation

When ride-through energy alone is not sufficient, the UBT+ can readily be integrated into a system with separate standby generators to give long term ride-through. Configured as such, the standby generators are isolated from load steps by the stabilisation characteristics of the UPS. The generators can be physically remote to the UBT+ and if desirable, in different voltage elements of the system. They can also be installed either electrically connected at the output or at the

input of the UPS. The generators may also be sized independently of the UPS to optimise the scheme assets. The advantages of this configuration over static UPS and generator systems include: the reliability, load handling and stabilisation benefits of UBT+ rotary UPS; a choice of ride-through without technical compromise; easy implementation either at low or medium voltages and preferential whole life costs. When compared with mechanically coupled diesel UPS systems, advantages include the ability to maintain the standby generator without compromising the UPS system, the option to feed the load directly from the generators, isolation of critical from essential (mechanical) loads and increased flexibility for system expansion or configuration.



UNIBLOCK™ UBT+ in standard configuration.



UNIBLOCK™ UBT+ with alternative standby generation options.

Innovation for your benefit

The UBT+ with Co-Generation

Co-generation plants are designed to make use of both the electrical energy generated and the heat by-product. Such systems, by themselves, have the advantage of much improved overall efficiency but they tend to have extremely poor dynamic behaviour. The UBT+ can be used to provide a link between the co-generation plant and the utility such that UPS power quality is maintained both in utility operation and in island mode. Excess power from the co-generation (or base generation) plant can be exported to the utility (subject to local regulations) with the safe knowledge that the UBT+ will isolate any effects arising from utility failure. Load supply instability immediately after the loss of a co-generation unit

can be eliminated by the stabilisation characteristics of the UBT+ whilst transfer to utility can be achieved seamlessly using the ride-through properties.

The UBT+ in the Isolated Parallel (IP) System Configuration

The UNIBLOCK™ UBT+ is available for high power applications with unit sizes ranging from 500kW to 2700kW. In medium voltage systems, units can be paralleled to 40MW, with individual or common coupling chokes. At low voltages, simple paralleling is limited to about 5MW but there are configurations using fault isolated parallel techniques that allow this to be increased to up to 20MW. The isolated-parallel system uniquely enables the advantages of combining

isolated-redundant and parallel-redundant UPS configurations offering outstanding maintainability and unique fault tolerance characteristics in data centre applications where high operational efficiencies are critical and minimising space requirement and maximising return on capital are of the highest priority. By reducing the redundant UPS units to a minimum and avoiding systems which run in the standby mode the IP system is an excellent choice for optimising the combination of redundancy, resilience and cost.

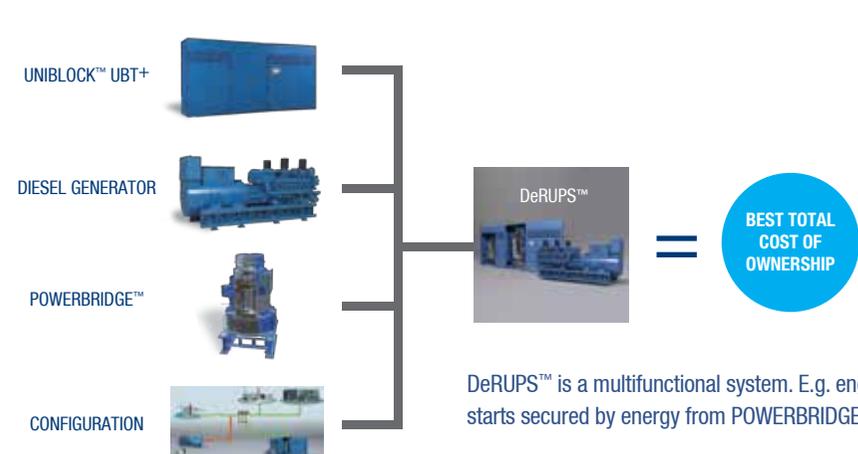
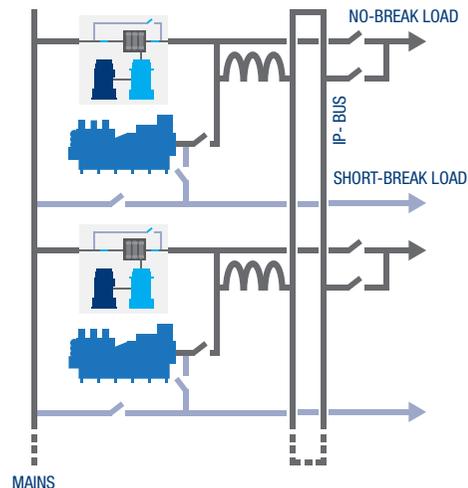
The UBT+ in the DeRUPS™ Configuration

Unique to Piller is the DeRUPS™ solution, an alternative to the more conventional DRUPS offering where a diesel generator is combined with UPS

either upstream or downstream and integrated in the control system of a UNIBLOCK™ UBT+ Rotary UPS to build a powerful and multifunctional system. This integration allows the use of external diesel generators in more complex designs, like IP-Systems, whilst providing the many advantages arising from the physical separation of the UPS and generator particularly with respect to greater freedom in choice of engine size or manufacturer and to improve resilience during maintenance.

As a totally integrated system, the DeRUPS™ configuration optimises efficiency, maintainability and flexibility whilst using the benefits of flywheel energy storage to guarantee seamless operation between the generator and UPS unit.

IP-Bus System with external generators downstream from the UNIBLOCK™ UBT+.





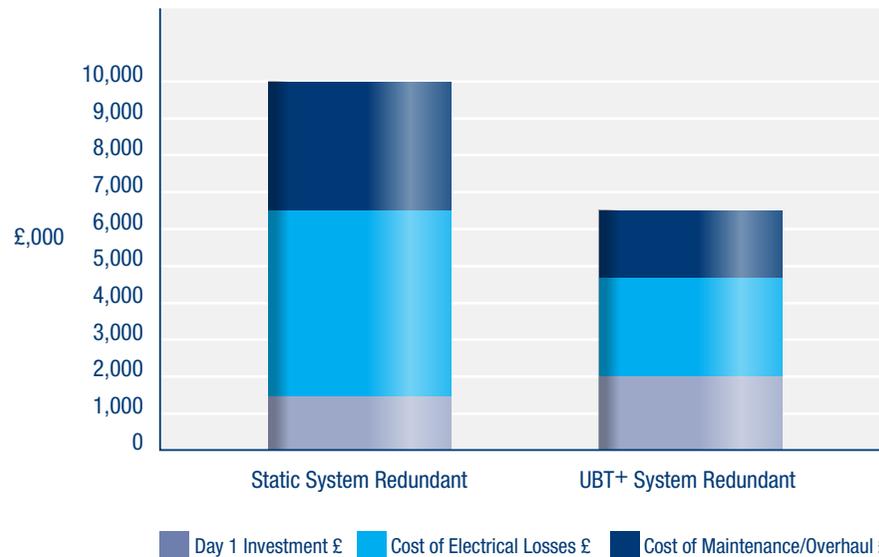
Total Cost of Ownership

Owning and operating a data centre or large scale industrial process plant is an expensive business; the cost of real estate and energy may heavily influence the final design and the location of the facility. Add to that the pressures of designing an environmentally friendly solution and the restrictions become even greater. First and foremost, a UPS must be reliable and secondly, it should deliver an optimised total cost of ownership (or TCO) over its useful life. The TCO for a UPS is a combination

of the capital expense, the electrical operating costs, the routine maintenance and the periodic overhaul or replacement. It is also dependent upon the required surrounding infrastructure including building space, running costs and capital costs for switchgear, transformers, cabling, power factor correction and cooling. In most TCO calculations, the dominant factor is the electrical running costs of the entire system and not the capital costs or the maintenance.

A TCO analysis incorporating the UNIBLOCK™ UBT+ system compares favourably with other solutions because of the combination of its characteristics:

- High electrical efficiency
- Natural cooling capability
- Simple maintenance regime
- Small footprint
- Long service life
- Complete flexibility of scheme design
- System + system redundant
- Common or individual bypass



Relative TCO comparison between static and UBT+ Rotary UPS solutions.

Taking care of your investment

After Sales Service

Piller believes that manufacturing a first class product with inherent high reliability is simply not enough. A UPS system must protect the client's interests just as well on its last day as it does on the first. The company prides itself in offering a worldwide network in the professional care of our clients' investment in Piller UPS through a team of highly trained and internationally coordinated technicians. At any moment, Piller technicians are taking care of over 9000 units of high power UPS equipment in over 40 countries, supporting clients' activities in data processing, banking and finance, industry, communications, aviation or defence, 24 hours a day, 365 days a year.

Emergency Response Service

Sometimes, support and expertise is needed when you least expect it. For those times, you need reassurance that help will be available in the shortest possible time. The Piller service centres are strategically positioned in relation to the installed base in order to provide both the best possible response time and local knowledge of the client's installation. Piller offers 24 hour emergency response and has technicians on standby for immediate dispatch at every one of our service centre locations.

Preventative Maintenance Service

Security of supply to the critical equipment is maintained by conducting correctly carried out periodic preventative maintenance. Preventative maintenance also minimises malfunctions and extends the life of the UPS system to 20 years or more.

Parts Availability

Piller preventative maintenance and emergency response services are fully supported by a network of stocked parts held both at the service centres and elsewhere in strategic locations around the world.

Consultation and Other Services

Ever changing demands in business can lead to the need for alteration, expansion or redeployment of a UPS system. Through Technical Support teams Piller can evaluate the requirements and advise on the necessary changes. They can also manage the delivery of these changes and consult with you and your partners to ensure the minimum of disruption.

- Replacement Battery Systems
- Reconfiguration and redeployment
- Upgrades
- Remote Monitoring Systems
- Site surveys

Operator Training

All newly installed systems will involve a degree of operator training conducted either at site or in one of our training centres. Piller offer further training by way of refresher courses and for new employees ensuring that client staff continue to have the skills necessary to operate the UPS system with the minimum of risk.





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STATIC UPS SYSTEMS
STATIC TRANSFER SWITCHES
KINETIC ENERGY STORAGE
AIRCRAFT GROUND POWER SYSTEMS
FREQUENCY CONVERTERS
NAVAL POWER SUPPLIES
SYSTEM INTEGRATION



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