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Achieving the Highest Power Density in the Smallest Footprint

White Paper Summary

For many years, mission critical applications have required high quality power conditioning and uninterruptable power to ensure business continuity. In recent years however, new efficiency matrixes have dominated the market and real estate has become more valuable, highlighting the need for high efficiency, low footprint solutions. The Diesel Rotary UPS (DRUPS) is no exception and in fact, with several innovations, has become increasingly viable for both small and large applications, while providing the lowest footprint of any UPS. This whitepaper examines the advantages of the Diesel Rotary UPS solution and explains how it can maximize on power density with the smallest footprint.

Whitepaper HitzWP001
Date May 17th 2016
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Introduction

Critical loads demand exacting standards and innovative application of proven systems to assure the infrastructure integrity. Hitzinger diesel rotary systems provide proven reliability and offer many advantages over the battery backed UPS and Standby diesel generator including; maximizing available plant room space, minimizing running costs, eliminating UPS air conditioning requirements and addressing some of the technical issues presented by large static UPS installations such as harmonic filtration, poor input power factor, no inherent fault clearing capability and maintaining a controlled battery environment.

Despite the many salient benefits provided by the DRUPS to mission critical applications; there is one huge advantage that is consistently over looked, yet is arguably one of the most significant benefits of the Rotary solution. We are referring to footprint, the ability to *'achieve the highest density in the smallest footprint*' to be exact. With the market applying constant pressure to UPS manufacturers to meet larger density power, top quality solutions, superior load handling and higher efficiency (>96.8%), the DRUPS solution is fast becoming the preferred choice for electrical supply critical installations.

UPS Comparisons

A. Battery Backed with Additional Standby Diesel Generator Operation

For any application requiring a long-term backup of the consumer, a diesel engine and alternator (otherwise referred to as a Diesel Generator) is required. The use of a Diesel Generator can supply the load for prolonged outages, but on average can take anything between 5-30seconds before it can supply power to the consumer. In mission critical applications, this short interruption in power can be catastrophic, however, a UPS system can be installed to bridge the time required for the Diesel Generator to supply power.

One way to bridge this gap is to use a static UPS, which uses a DC battery backup to support the load until the Diesel Generator upstream can get to speed. For these DC batteries to keep charge the static UPS requires a rectifier and inverter; which converts the mains utility supply from AC to DC, providing a DC power to float charge the battery bank. In stand-by operation, the Inverter will supply AC output, albeit with an artificial sine wave, to the consumer. See figure 1 below, demonstrating the normal power flow to the consumer in stand-by operation.

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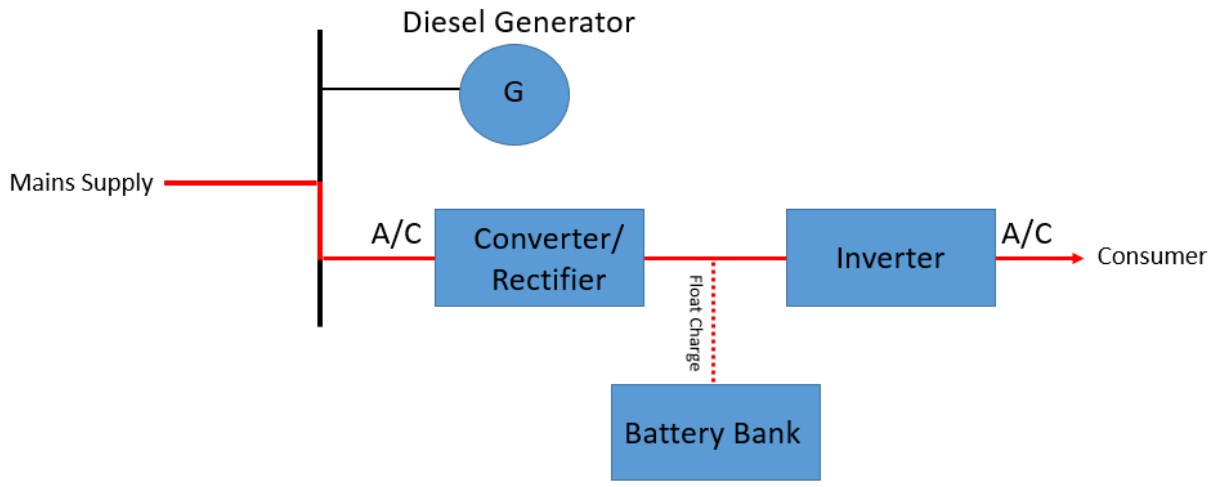
Figure 1 – Static UPS Power Flow in Stand-by Operation



The above diagram is a simplistic overview of a typical static UPS, however, to ensure top quality power conditioning some static UPS systems may require additional Power Factor Correction and harmonic suppression equipment (not shown). In addition, static UPS systems require costly air conditioning in the battery rooms to ensure maximum life. In the event of mains failure, the DC battery bank will support the load via the inverter and provide adequate time for the diesel generator upstream to supply power.

Figure 2 – Static UPS Power Flow in Battery Operation.

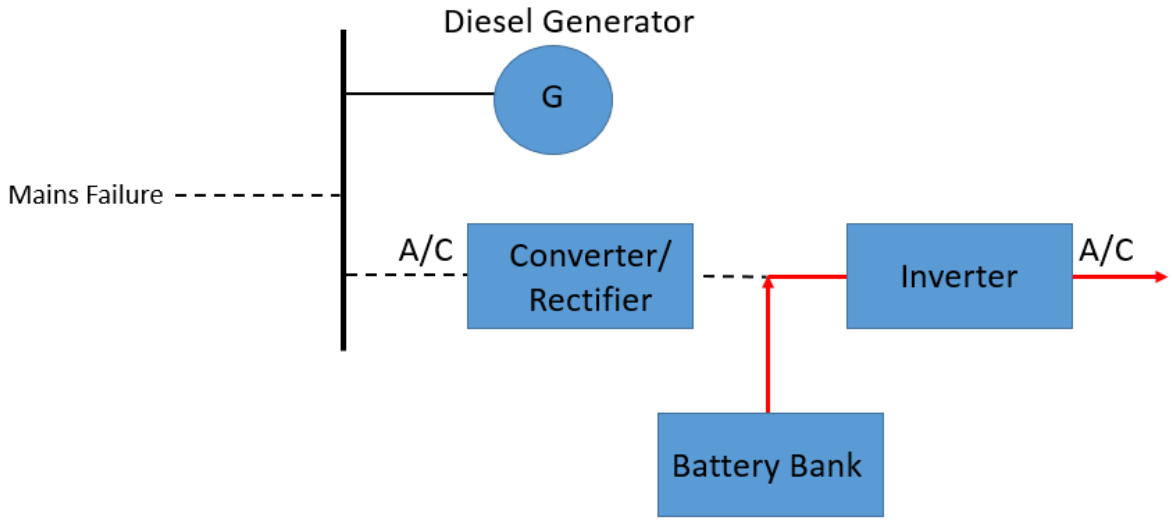


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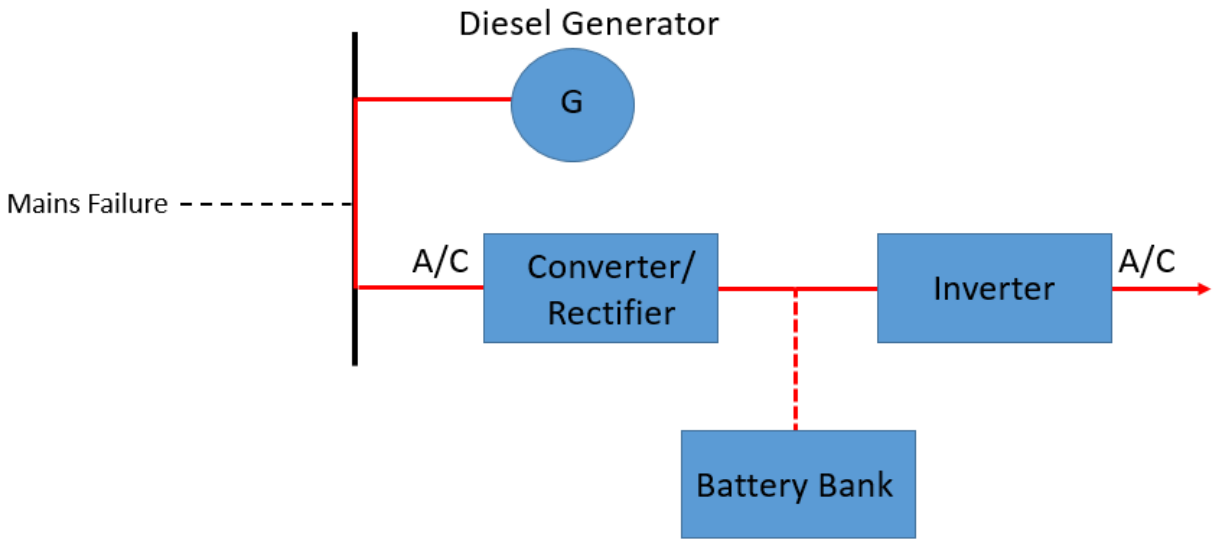
Figure 3 – Diesel Generator Supplying the Load



In conclusion, to bridge just 30-seconds of power, the static UPS requires an extremely large footprint as well as high operational costs and costly battery overhauls.

B. Diesel Rotary UPS systems (DRUPS)

An alternative to battery backed UPS are Diesel Rotary UPS systems (DRUPS) that significantly reduce the footprint by mechanically combining the UPS and Diesel Generator. Unlike the static UPS that require a battery bank to support the load during mains failure, a DRUPS uses a kinetic energy storage module mounted at the end of the alternator shaft. This simple mechanical storage means that the DRUPS solution is only 2 - 4.5ft longer than the equivalent generator (Depending on size – 150>3000kVA), but provides the same uninterruptable power in a significantly reduced footprint.

In normal operation, the engine of the DRUPS system is off and clutch is open, thus separating it from the alternator. The alternator and Kinetic storage module are both spinning 365days/year 24hrs/day, acting like a synchronous motor on the mains. This motor, in connection with an inline choke (Inductor), provide conditioning of the mains supply. In normal operation, the outer rotor of the Kinetic storage module spins approximately twice as fast (3000rpm) as the alternator rotor (1800rpm synchronous speed). In the event of mains failure, the faster outer rotor slows down in order to maintain the speed of the alternator shaft at 1800rpm. At the same time, the diesel engine receives a signal to start and becomes the prime mover of the alternator within 5- 7seconds.

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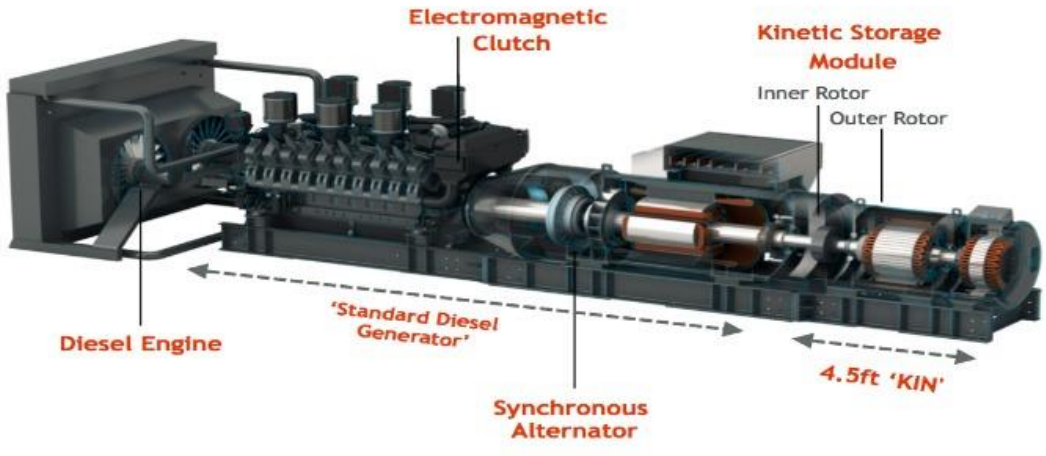
Hitzinger Solution

Highest Power Density with the Lowest Footprint

The Hitzinger Diesel Rotary UPS uses a simple mechanical coupling to join a flywheel onto the Diesel Generator thus mitigating the need for the Static UPS components including; Rectifier, Inverter, Batteries including DC breakers and DC Bus, power factor correction capacitors, harmonic suppression and Air Conditioning.

In total, a Diesel Rotary UPS will save between 40-60% footprint (dependent on the total load).

Figure 4 – Hitzinger Diesel Rotary UPS System



Hitzinger DRUPS solution - providing vital space saving technology with 40-60% more efficient results to better serve your business.

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Please consider this: A diesel generator (Engine and Alternator) is required for **both systems**, as the long-term back-up of the mains. The additional flywheel for the DRUPS only adds approximately 4.5ft for the largest system (3000kVA) and takes full advantage of a standard diesel generator installation, including both internal and containerized solutions. No additional equipment is required to fully support the application and no costly air conditioning is required.

The larger the system, the higher percentage of footprint savings is created. In addition, the DRUPS can provide a medium voltage solution using a direct generation alternator (>15kV), providing simplistic distribution solutions. The simple design of a DRUPS system provides top quality conditioned power within an extremely reliable compact solution.

Conclusion

The Hitzinger solution provides significant advantages, both commercial and technical. Our system benefits from over 70-yrs of turnkey power solution experience and provides the lowest maintenance, including overhaul, of any UPS. Coupling the Kinetic storage module to the Diesel generator means that costly battery overhauls can be avoided and with high efficiencies of >96.6%, the Hitzinger solution can help reduce running costs of UPS to a minimum.

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About the Author

Ben Jones is the CEO and President of Hitzinger USA. He graduated from London Southbank with a Bachelor of Science with Honors and a holds a Master's Degree from Greenwich University. He has worked with Hitzinger since 2005 where his tenure began in the UK, and has extensive experience with design and installation of turnkey power solutions.

Other Whitepapers are available upon request, please email benjones@hitzinger.us and receive a full list of whitepapers currently available.

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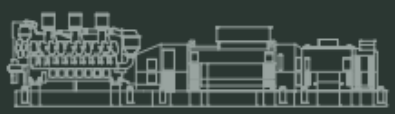
DDUPS SYSTEMS

U POWER Dynamic Diesel Uninterruptible Power Supply



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