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MOBILE UPS SYSTEMS
COMPARISON OF TECHNOLOGIES AND APPLICATIONS

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Summary

Today, several types of loads and applications require a high-quality, uninterrupted electrical power supply (eg. datacenters, production facilities, airports...). One important element connecting these types of loads is the high cost related to an interruption of the power supply, ranging between tens of thousands up to millions of euros. For such critical loads, UPS systems have become a key element in the power supply.

This white paper focuses on mobile UPS systems, installed in a container or enclosure that is easily movable, allowing deployment on a site in need of (temporary) UPS protection. This demand has some repercussions on the system design and feasibility. A comparison of the most important UPS technologies and configurations learns that not every UPS technology is equally suitable for mobile design and application. In general, the more robust and compact technologies, such as DRUPS systems and diesel generators, are more suitable for mobile configuration, while hybrid or static UPS systems tend to be more sensitive to environmental conditions.
The integration of a mobile UPS system can be useful for protecting the power supply of critical loads on all temporary occasions, for customers who are already in possession of a fixed UPS system or not.

Content

Introduction

Today, several types of loads and applications require a high-quality, uninterrupted electrical power supply – examples are datacenters, production facilities in which accurate and continuous control of environmental conditions and/or process parameters is paramount, airports,... One important element connecting these types of loads is the high cost related to an interruption of the power supply: in that case, the unavailability could result in a loss of customer data and transactions, loss of products, important safety hazards,... which often imply a cost ranging between tens of thousands up to millions of euros. In order to prevent such damage (technical, economical and/or commercial), UPS systems have become a key element in the power supply of such critical loads.

This white paper focuses on mobile UPS systems. As opposed to their fixed counterparts, these systems are installed in a container or enclosure that is easily movable, allowing deployment on a site in need of (temporary) UPS protection. This demand has some repercussions on the system design and feasibility. First, the most important UPS technologies and configurations are presented and compared, focusing on the specifications required by the mobile design and application. Next, the applications and cases in which a mobile UPS provides the best answer to the customer's demands and specifications are outlined.

UPS technologies and configurations

(Photo 1 - MUPS on the road Luminus Solutions)

As stated in the introduction, the main goals of a UPS system are:

- Providing an uninterrupted electrical power supply to the critical loads connected to the UPS – independent of the utility grid conditions (long or short interruptions, voltage sags and swells...)
- Providing a high-quality voltage to the critical loads – this involves filtering and compensation of disturbances on the utility grid, e.g. voltage harmonics, dips and swells, frequency variations...
- Minimizing the impact of load-side disturbances on the utility grid – the reactive power and current harmonics drawn by the loads is delivered by the UPS system and not by the utility grid, in order to limit propagation of power quality problems and disturbances towards the utility grid (where they might impact other loads and customers).

This paper focuses on UPS systems for a rated power of 100 kVA or more. This means some UPS configurations are not mentioned, more specifically some of the static (battery) UPS configurations often used for low-power applications (e.g. offline or line-interactive static UPS systems). This section describes the most important UPS configurations for the given power range, with their principal advantages and drawbacks and opportunities for mobile application.

Static UPS systems

An online (or double conversion) static UPS system (see Figure 1) consists of the following components:

- DC-bus – this bus is used for connecting the inverter on one side and the rectifier and storage systems (batteries, capacitors, flywheel...) on the other side.
- Storage systems – the most frequently used technology is an electrochemical battery, but (ultra)capacitors and flywheels can be used as well. The systems provide the necessary energy for bridging a relatively short grid failure (typical autonomy: 5-10 seconds to 30 minutes) or the time required to start a diesel generator.
- Inverter – used for converting the DC-voltage at the DC-bus into AC-voltage at the output.
- Rectifier – used for converting the grid's AC-voltage into DC-voltage, used to supply the output inverter as well as the charging converters for the energy storage units.
- Bypass – in case of an overload condition, maintenance or a failure to the power electronic converters and/or the storage units, the UPS system transfers to the static bypass. Apart from the automatic bypass (which is activated automatically in case of an overload at the output of the UPS), most systems have a manual bypass (e.g. for planned maintenance). In bypass mode, the loads are directly supplied by the utility grid, without additional protection against disturbances and interruptions.

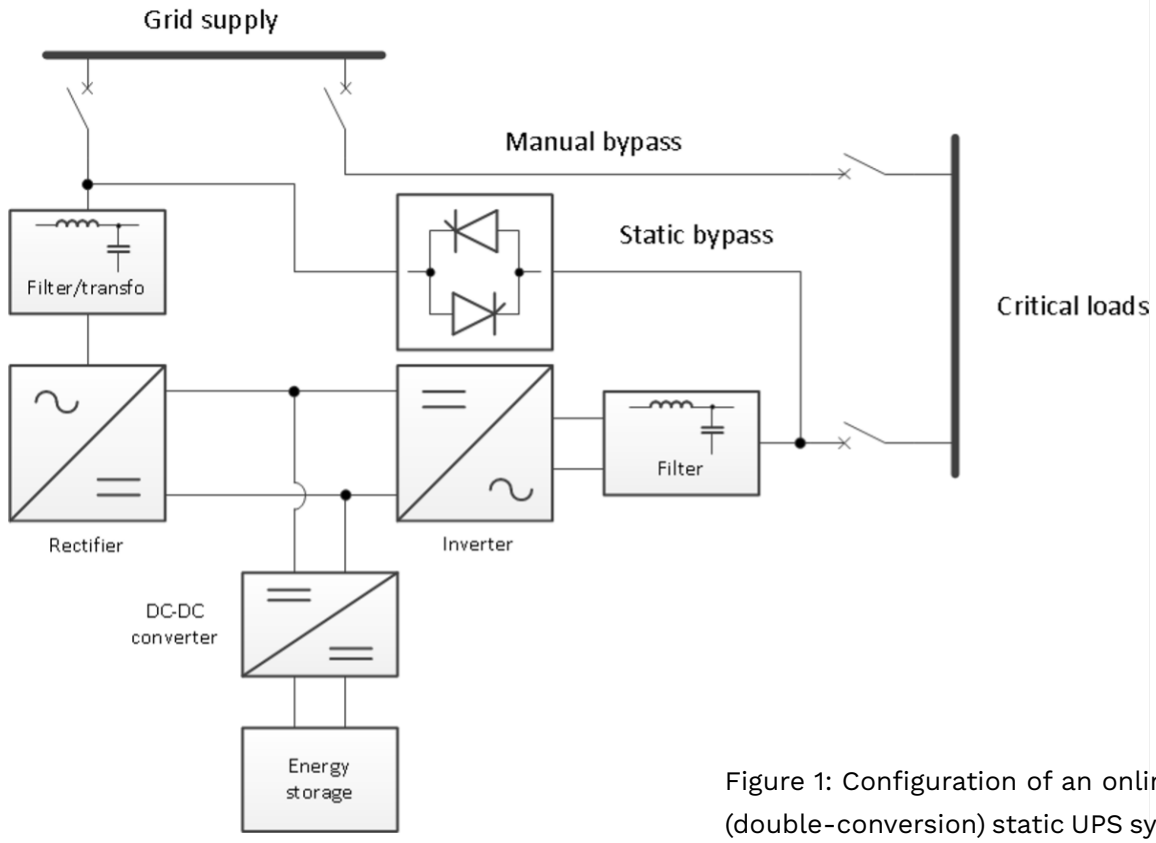

Figure 1: Configuration of an online (double-conversion) static UPS system