

Introduction

What is a central power supply system?

A Central Power Supply system (CPS) is essentially a large set of batteries at a single central location. In the event of a mains failure in the building, the batteries are used to provide reliable power for emergency lighting purposes.

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01 Cost of ownership
(CBS vs Self-contained)

Central Power Supply System (CPS):

This is essentially a large set of batteries at a single central location.

Features:

- The CPS output will typically be 24V, 50V, 110V, or 220/230/240/380/400V, according to type & regional requirement.
- Output is usually AC/DC for the lower voltages, and AC when mains voltage.
- The CPS will be sized according to the load required.
- The battery will be rated to achieve a specified duration, typically 1, 2, or 3 hours.
- A larger project may use one single large CPS, or a number of smaller CPS units.

How does it work?

The CPS effectively stores energy in the battery set whilst the mains supply is healthy, and draws upon this reserve when required in times of mains failure. If the failure is limited to part of the building (local), the CPS may provide power using its incoming supply without discharging the battery.

Mains failures are detected by sub-circuit monitoring relays to ensure the automatic, fail-safe operation of the emergency lighting. These are situated around the building where required, or may be located within the CPS itself.

Power from the CPS is distributed to dedicated emergency luminaires and exit signs, or converted slave 230V luminaires. Standard, unmodified slave 230V luminaires can be used on a mains-voltage CPS. Distribution cables need to be fire protected, according to local regulations and/or risk assessment.

Who decides?

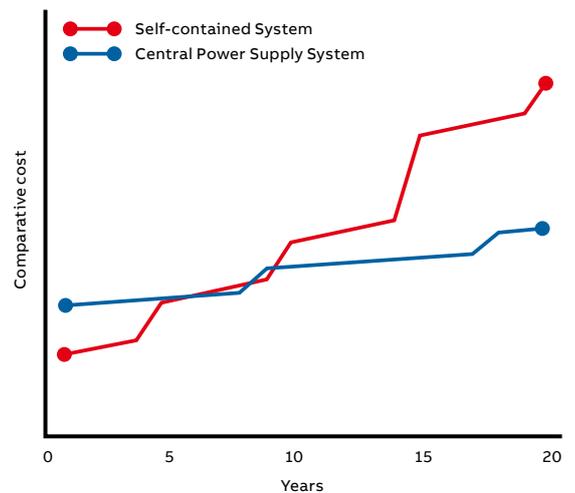
The voltage of the CPS is influenced by the size and nature of the project. The final decision may be taken by the consultant, end user, or contractor.

The duration or autonomy of the CPS is often dictated by national Standards (eg BS 5266), or local authority requirements.

What are its benefits?

A CPS system gives a higher light output per point when compared to a self-contained installation, and therefore will use fewer emergency lights per area.

A CPS solution offers great savings in ongoing testing, maintenance, and replacement battery costs when compared to a self-contained emergency lighting installation.



Introduction

Which category fits your needs?

Central systems fall into two categories: AC/AC static inverter systems and AC/DC power supply systems. Both types of central system operate on the same principle. The luminaire is fed, via emergency sub-distribution, from the central system.

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01 Static Inverter
Systems (AC/AC)
—
02 Central Power
Supply Systems
(AC/DC/EMEX 110)

Two categories central systems:

- AC/AC static inverter systems
- AC/DC power supply systems.

Same principal:

The luminaire is fed, via emergency sub-distribution, from a single supply source (the central system).

Static inverter:

The term 'static inverter' is derived from the lack of moving parts within the equipment, as opposed to rotary motor / generator converter designs.

Static Inverter Systems (AC/AC)

Static inverter systems operate in a similar manner to AC/DC Central Power Supply Systems, with the exception that the system constantly gives a 230V AC output. The advantages of this approach are numerous. Firstly, luminaires do not need to be converted, as any slave 230V luminaire can be used (there are some restrictions to this on the grounds of suitability for emergency lighting). Luminaires also operate at full light output, as they are being fed from a full mains voltage supply, meaning fewer luminaires are required for equivalent light outputs.

Advantages

- Suitable for medium to large installations
- Almost any luminaire may be used
- Easy to maintain
- 10 to 25 year design life batteries
- Distribution is standard 230V AC (standard DBs)
- Reduced volt-drop problems on output cabling
- Luminaires operate at full light output
- Ideal for modern LED lighting installations to capitalise on energy reduction

Disadvantages

- Bigger systems are physically large and may require a special battery room
- Smaller installations are ideal for EMEX mini installations (See EMEX mini section for suitable solution)

Central Power Supply Systems (AC/DC)

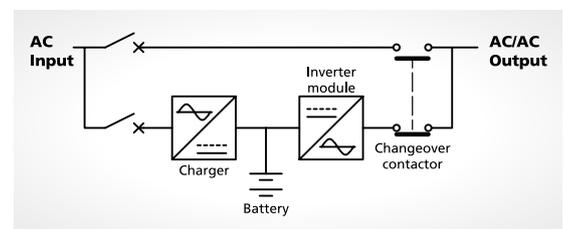
Central Power Supply Systems provide low voltage AC power (nominally 24V, 50V or 110V AC) whilst mains to the system is healthy, and low voltage DC (of the same voltage) when mains fails. The battery voltage selected will depend upon the number of luminaires, the rating, their type and their distance from the central system. Central Power Supply Systems require each emergency luminaire to be converted for use on the low voltage supply. The cost of this conversion may be prohibitive on larger installations. Another important factor is that converted luminaires only provide a small percentage of their normal light output when running in emergency mode.

Advantages

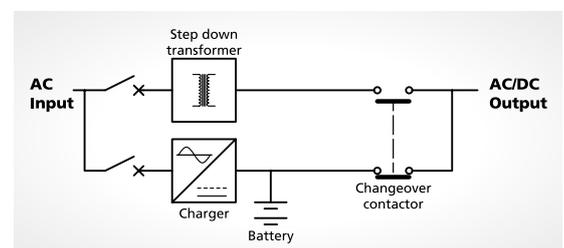
- Reduced cost for smaller installations
- Small physical size
- Easy to maintain
- 5 to 25 year design life batteries

Disadvantages

- Not cost effective for large numbers of luminaires
- Cable restrictions to avoid volt-drop
- Luminaires must be converted for use on AC/DC
- Reduced light output in emergency mode



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02

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Practical insights on self contained battery life

Principle types of emergency lighting system are ‘self-contained’ or ‘centrally fed’. In a self-contained system, each emergency luminaire has an on-board battery and charger unit. A Central power supply system operates on the principle that the luminaires are fed, via sub-distribution, from a single supply source.

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01 Emergency lighting
system reference

Self-contained System

Batteries/charger contained in individual luminaires

Advantages

- Simple installation
- No special cabling
- Economic for smaller installations with a limited total number of luminaires

Disadvantages

- Limited light output
- Multi-point maintenance
- Battery replacement 3 – 5 years
- System design life 15 years maximum

Insights on battery replacement

A typical self-contained emergency power pack has an operational design life of 10 – 15 years, and will require a replacement battery every 3 – 5 years. The installation is straightforward and, by definition, each luminaire is installed and maintained independently of all others on the site.

Battery life 3-5 years:

The instance of battery failures may increase, resulting in the possibility of further unplanned maintenance visits to replace battery sets.

Battery life after 5 years:

It is recommended that battery condition is reviewed on a regular basis. Typically following 5 years use, a full battery replacement should be carried out.

Considerations

It can be considered that self-contained products will require 2 or more complete sets of replacement batteries during the first 10 years of operation. Approaching 15 years, it is likely that the luminaires within a self-contained system will need to be changed. It should be noted, that a more rigorous and beneficial planned maintenance schedule can be achieved, utilising a suitable automatic or controlled test and monitoring system, to check the luminaires and their batteries ('Centrel', IR2, Naveo: available from Emergi-Lite).



Introduction

Choosing the right system for emergency lighting

There are a variety of ways in which back-up power can be provided, however, even though certain methods are suitable for critical applications, they may not necessarily be suitable for emergency lighting.

General information on Uninterruptible Power Supply Systems (UPS), for guidance:

Why is it different?

This is because an Emergency lighting system has unique load characteristics. Since emergency lighting is a critical lifesafety installation, it is vital that a central power supply system selected to power emergency lighting is designed with these load characteristics in mind.

EMEX Power central inverter systems are specifically designed to provide emergency power for lighting systems in a mains fail or evacuation situation.

In choosing the right AC system to support emergency lighting it is important to consider the following questions:

Cold load startup performance

BS EN 50171 requires that an inverter must be able to start the full load without the mains supply present. How does the system perform in a total power failure (ie is the system able to start the load without the bypass supply being available)?

Repeat duty

BS EN 50171 requires a Central power supply system to fully recharge within 24 hours. Is the charger able to recharge the batteries sufficiently quickly (80% in 12 hours or 100% after 24 hours)?

Energy consumption and heat dissipation

Is the inverter and charger permanently running, reducing the battery life, generating heat and wasting energy?

Are cooling fans running continuously, generating noise and reducing component life?

Maintenance

Is the system easy to service and maintain? Is the system designed in a modular format, or would the

failure of even a minor component require the whole system to be shut down and stripped for repair?

Recharge period

UPS systems which are designed primarily for computer backup generally offer short back-up times, and consequentially employ small chargers. To provide the longer durations specified for emergency lighting, a much larger capacity battery is fitted. However, if the charger is not updated then the system will not be capable of recharging sufficiently quickly. Hence the battery rating is sometimes increased even further so that it is not fully discharged at the end of the rated duration period (and is thus capable of "repeat duty" with limited further recharge). This results in a much larger system that is actually required for the load, increasing both the physical space required and future battery replacement costs.

Overload and short circuit performance

An emergency lighting load imposes large 'in-rush' currents when starting lamps from cold. However, UPS systems are often designed to shut down at only 125% overload and revert to the incoming supply. During a total power failure situation, this could result in total failure of the emergency lighting system. Furthermore, a UPS may fail to clear a protective device on a lighting circuit, meaning that a single short circuit fault could result in loss of the entire emergency lighting provision.

Energy consumption and battery life

Most UPS systems operate in the 'on-line' mode, whereby the inverter runs constantly to supply the load, and power is taken from the battery with the charger running constantly. This places an excessive ripple on the battery (in contravention of the advice given by most battery manufacturers). Also, the system is constantly generating heat which has a further detrimental effect on battery life. There are energy cost implications to run an on-line system, and deal with the heat generated.