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Guidance Note

Telecoms Back Up Power Selection Guide

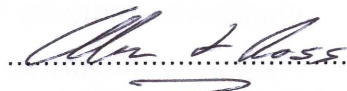
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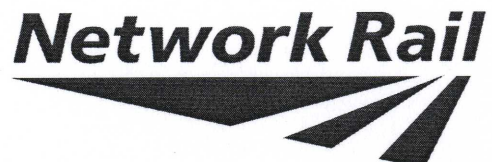
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Issue record

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Reference documentation

NR/SP/TEL/30025	Standby power supply requirements for operational telecommunication equipment.
NR/PS/ELP/00007 NR/CS/ACC/029	Product Specification for Uninterruptible Power Supply Product Acceptance (formerly RT/LS/P/029)
NR/GN/ELP/00011	Guidance note for uninterruptible power supply equipment
NR/GN/ELP/27315	Guidance note: Management of power supplies to Telecomms equipment
EN 62010-3	Uninterruptible power systems (UPS). Method of specifying the performance and test requirements
EN 61000-6-4	Electromagnetic compatibility (EMC). Generic standards. Emission standard for industrial environments.
EN 61000-6-2	Electromagnetic compatibility (EMC). Generic standards. Immunity for industrial environments
EN 50121-4	Railway applications. Electromagnetic compatibility. Emission and immunity of the signalling and telecommunications apparatus.
EN 60950-1	Information technology equipment. Safety. General requirements
EN 60146	Semiconductor converters. General requirements and line commutated converters.
EN 60896	Stationary lead acid batteries. General requirements and methods of test.
ETSI EN 300 019-1-3	Environmental conditions and environmental tests for telecommunications equipment; Part 1-3: Classification of environmental conditions; Stationary use at weather protected locations
ETSI ETS 300 019-1-1	Environmental conditions and environmental tests for telecommunications equipment; Part 1-1: Classification of environmental conditions; Storage
ETSI EN 300 019-1-2	Environmental conditions and environmental tests for telecommunications equipment; Part 1-2: Classification of environmental conditions; Transportation

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1 Purpose

This document aims to explain at a fairly generic level the functions of the various different power plant systems used by telecoms and provide some guidance in compiling the required systems from the approved modules.

2 Scope

This guide is limited to the 230Vac, negative 48Vdc and negative 24Vdc power supply systems up to and including 10kVA for Telecoms applications. Larger systems are the responsibility of E&P.

3 Recommended Process for Defining a New Power System

Telecoms have traditionally provided suppliers of power systems with the overall power requirements and depended on suppliers to design the solution.

The recommended approach to defining a new power systems is provided below.

1. User Determine power loading required
Ideally the actual power used by the equipment should be measured as this is often substantially lower than rated power
2. User Determine length of time required for autonomous operation (back-up time)
Discuss the application with E&P to determine whether there are any back-up systems in place on the site and if so, what the maximum time the system may be down for
3. User Complete fields highlighted in yellow in the appropriate spreadsheet – either AC-AC or AC-DC (see attachments to this document)
4. User Select appropriate power solution(s) from the selection guide
5. User Send spreadsheet to the manufacturer(s) of the selected power solution(s).
6. Supplier Design system and complete remaining fields in spreadsheet.
7. Supplier Return spreadsheet with quotation for solution.
8. User Review spreadsheet and check that good choices have been made.

This guide does not break this dependency. It does however provide some fundamental information to the users to help them understand the proposed system designs and to challenge them if necessary. To help the readers further, there are also guidance tables for Eltek DC power plant system configurations with the approved modules. It is the reader's responsibility to confirm the approval status of the modules at the time of use.

This guide covers UPS, systems, rectifiers and inverters, but not the batteries. The user should use batteries recommended by the power supply system manufacturer.

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4 Definitions

AC

Alternating Current

AC to AC Static Switch

The static switch is used to stabilise, filter and regulate the inverted AC or the mains input to the load.

AC to DC Converter

The converter is also known as rectifier-battery charger. It converts the AC mains supply to a DC supply to power the inverter and charges the battery.

Automatic Bypass Switch

Used with a UPS, it automatically switches the incoming mains directly to the load if the UPS is overloaded or develops a fault.

Battery

Charge store which provides power when the mains supply is absent.

DC

Direct Current

E&P

Electrification and Plant

Inverter

Converts a DC voltage into an AC voltage

LDT

Load Discharge Test

Manual Bypass Switch

Manually operated switch (used with UPSs) that connects the incoming mains directly to the load, which allows the UPS to be taken out of service without disrupting the supply to the load.

PADS

Parts and Drawings System

UPS

Uninterruptible power supply

VFD

Voltage and frequency dependent. Also known as Off Line

VFI

Voltage and frequency independent. Also known as On Line or Double Conversion

VI

Voltage independent. Also known as Line interactive

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5 Introduction

Telecoms normally use three types of power conversion systems:

- AC to AC, i.e. uninterruptible power supplies (UPS)
- AC to DC, i.e. DC power plant
- DC to AC, i.e. inverters (rarely used except as part of a UPS)

All of these systems facilitate battery backup to the load in the event of mains supply failure.

6 AC to AC: UPS

A UPS takes AC from the mains supply and outputs AC to the load. Although its primary function is to guarantee the AC supply to the load in the event of a mains failure, it also:

1. Filters out spikes and electrical noise from the supply
2. Absorbs momentary mains interruptions and transient voltage surges
3. Regulates the mains supply's waveform and frequency.

6.1 UPS Types

According to BS EN 62010-3 there are three main types of UPS:

1. Voltage and Frequency Independent (VFI). Also known as On Line or Double Conversion. The output of the UPS is unaffected by limited fluctuation in the mains voltage or the mains frequency. The limits are as per ENV 61000-2-2.
2. Voltage and Frequency Dependent (VFD). Also known as Off Line. The output of the UPS tracks both the voltage and frequency of the input mains supply.
3. Voltage Independent (VI). Also known as Line Interactive. The output voltage is regulated and stabilised within a defined specification.

VFI is the preferred UPS system for telecoms applications.

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6.2 Typical Voltage and Frequency Independent System

A typical VFI UPS consists of six main components as illustrated below;

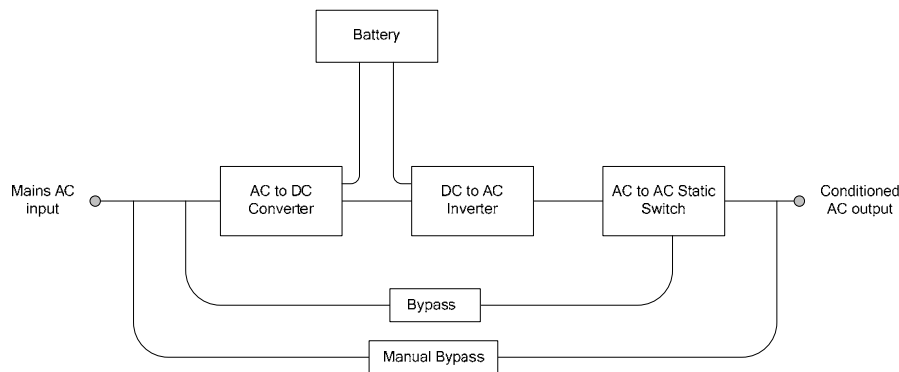


Figure 6-1: Principal parts of a voltage & frequency independent UPS

- AC to DC Converter**
 The converter is also known as rectifier-battery charger. It converts the AC mains supply to a DC supply to power the inverter and charges the battery.
- Battery**
 This provides the system autonomy when the mains supply is absent.
- Inverter**
 Under normal working conditions the inverter is powered by the output of the converter, but in the absence of mains supply the battery powers the inverter for the autonomy duration, or until the mains supply is restored.
- AC to AC Static Switch**
 The static switch is used to stabilise, filter and regulate the inverted AC or the mains input to the load.
 If the static switch is connected directly to the incoming mains via the automatic bypass it continues to work as a frequency converter.
- Manual Bypass Switch**
 This switches the incoming mains directly onto the load. This allows the UPS to be taken out of service without disrupting the supply to the load.
- Automatic Bypass Switch**
 Some models have an automatic bypass feature which switches the incoming mains directly to the load if the UPS is overloaded or develops a fault.

7 AC-DC: DC Power Plant

A 48 Vdc load usually has a supply DC to DC converter to convert the 48 Vdc to voltages suitable for the actual electrics. As far as the DC power plant is concerned this represents a constant power load.

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A typical DC power plant consists of two main components as illustrated below;

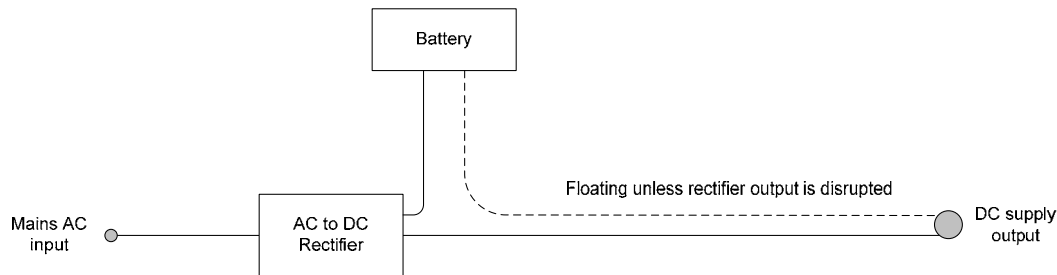


Figure 7-1: Principal parts of a DC power plant

1. The rectifier converts the AC mains supply into a DC supply to support the load and to charge the battery. In most cases the rectifier is a plug-in module. The number of rectifiers within a system depends on the load and the redundancy required.
2. Under normal operation the load is supported by the rectifier, but in the absence of the incoming AC mains supply, the battery powers the load for the autonomy duration.

8 DC to AC: Inverter

An inverter converts DC to AC. A generic system is shown below;

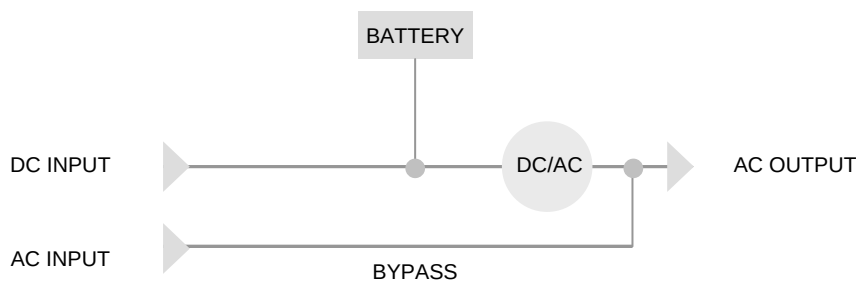


Figure 8-1: Principal parts of a DC to AC inverter

1. An inverter may be connected to the output of a DC power plant provided the DC power plant is adequately rated.
2. The bypass switch allows the load to be switched to the AC mains whilst the inverter or the DC power plant is disconnected for maintenance.

An inverter may be used in the Continuous Operation mode or in the Back-up Operation mode. The continuous mode is recommended otherwise failure of the back-up system will not be detected until the mains supply also fails and the system is unable to support the load.

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8.1 Continuous Operation

The inverter continuously draws current from the battery to support the load. Should the inverter fail, the bypass switch can be used to revert the load to an AC mains supply. For well-designed inverters, the operation of the bypass should only introduce a very short drop-out time, which the load should be able to tolerate.

8.2 Back-up Operation

In this mode the inverter is normally off and the load is supplied directly from the AC mains supply. When the AC supply fails, the inverter is activated to supply the load, which generates a longer supply interruption to the load than continuous operating systems.

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