UPS Types Explained

Any UPS consists of three main assemblies:

1. A rectifier-battery charger (converter):
Changes the mains supply ac voltage and current into the levels of dc voltage and current required to charge the battery and power the inverter.

2. A set of batteries (usually of the sealed lead-acid type):
Stores dc electrical energy and power an inverter for periods from several minutes to many hours. For large three phase UPS a DC flywheel can provide this function for a limited time.

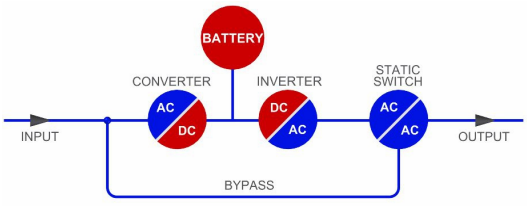
3. A static converter (inverter):
Converts the stored dc supply into an ac voltage waveform, stabilised, filtered and regulated to supply the connected load(s).

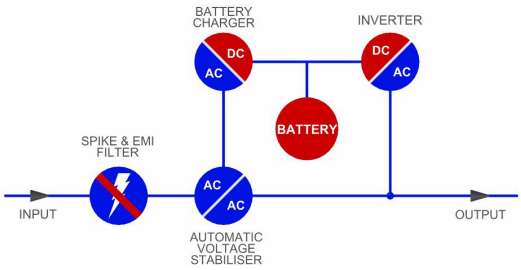
Three Main Types of UPS as described by BS EN 62040
Many different types of UPS have been developed to meet specific customer requirements for power quality, mains failure protection and price. The current method for classifying the three main UPS types is described in BS EN 62040-3:2001

1. VFD (Voltage and Frequency Dependent)-
More commonly known as **OFF LINE** where the output of the UPS tracks the mains power supply in terms of voltage and frequency variations.

2. VFI (Voltage and Frequency Independent)-
More generally known as **ON LINE or DOUBLE CONVERSION** where the output of the UPS is independent of any fluctuations in the power voltage (mains) and frequency variations are maintained within the limits prescribed ENV 61000-2-2 (CEI 110-10). This type of UPS can operate as a frequency converter.

3. VI (Voltage Independent)-
Usually known as **LINE INTERACTIVE** where voltage fluctuations are stabilised and regulated to within an output specification by built-in passive/electronic regulation devices.





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UPS Types Explained

UPS SIZING

When calculating size of the UPS, it is important to take into account the following:

Apparent power (VA or kVA)- This is defined as S=VxI for single-phase loads, S=(VLI x ILI)+(VL2xIL2)+(VL3xIL3) for three-phase loads where V is the voltage, and I is the current absorbed by the load under normal operating conditions (EN50091-1-1). This information can usually be found on rating hardware labels, and in the documents and information supplied with the system(s) to be protected. It is generally over estimated.

Active power (W or kW)- Is defined as P=S x pf where pf is the power factor. If the value of P and pf of the load is not specified, the power must be precisely measured in order to correctly size the UPS. The typical load of a computer is associated with a pf of between 0.65 and 0.8. Active power is particularly relevant when sizing batteries.

Overloads- Are voltage and current demands on the UPS in excess of its specification. They may be temporary during initial energising of a system or constant where too much steady state load is connected to the UPS output.

System Expansion- The reliability of any electronic device is improved when run at less than 100% of capacity. For UPS the load should be around 90% of the system size to guarantee long-term reliability. A factor should also be added for future expansion of the protected load. This is typically taken as 25%.

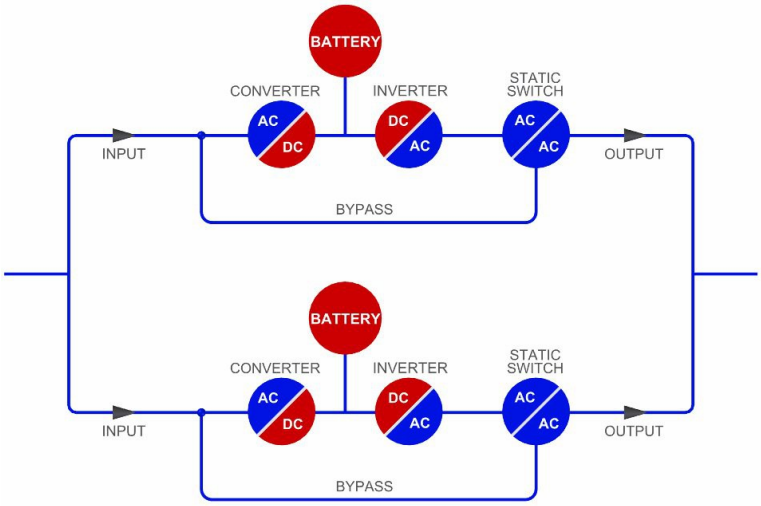
High switch on current demands- At power-on, some loads have a high initial switch on current demand lasting for a short time period (50 to 100ms). For example laser printers, some types of lights, isolation transformers and pumps. For these types of load it is good practice to oversize the UPS by a factor of at least 3 or remove them from the protected system, especially when they can be allowed to power down on mains failure.

UPS IN PARALLELAND REDUNDANTCONFIGURATIONS

In network, enterprise wide and industrial installations, UPS may be connected in parallel or redundant configurations:

Parallel- To obtain a kVA / kW output higher than that of any single UPS. For example 2 x 200kVA modules may be connected in parallel to achieve a 400kVA output.

Redundancy- To improve the overall UPS system resilience by applying the principle of N+1. Here 2 x 200kVA modules may be connected in a redundant configuration to supply up to 200kVA. Should one module fail or be taken out of service for maintenance the remaining module is sufficiently sized to power the load.



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UPS Types Explained

UPS OPTIONS

Some of the following are built-into specific UPS as standard. Others may be options available on request:

GALVANIC ISOLATION

Not all Off-line, Line Interactive and transformerless On-line UPS provide galvanic isolation. This is a separation of the mains and output supply of the system, principally disconnecting the input and output neutral. Without Galvanic isolation on sites with high levels of spikes, transients and electrical noise, the neutral can act as a direct path for the electrical pollution to reach the load(s). Galvanic isolation can be achieved using a transformer (normally housed in a separate cabinet). The transformer will also prevent interference from the load and UPS being injected back into the mains supply, and if configured can provide an isolated bypass supply during UPS maintenance.

HARMONIC FILTERS and 12-PULSE RECTIFIERS

Smaller single phase UPS up to 10kVA, typically have a sinusoidal input current waveform and do not generate significant harmonics into the local mains supply. Harmonics can pollute downstream hardware and prevent synchronisation of the UPS to a generator supply. The problem is typically found with larger single and three phase UPS having a 6-pulse rectifier. The solution is to install a harmonic filter or upgrade the 6-pulse rectifier for a 12-pulse system.

MONITORING OPTIONS

LOCALCOMMUNICATION

FRONT PANEL LEDs

Coloured LEDs provide immediate status indication and are usually sufficient for small single phase UPS.

ALPHANUMERIC DISPLAY

A front panel LCD can provide additional information on UPS, battery and mains operating conditions such as Load %, Battery Charge %, Mains Voltage and Runtime available. Such a facility normally provides access to stored historical logs and operating parameters for on-site customisation.

REMOTE COMMUNICATION

USING SIGNALCONTACTS

If the UPS front panel is not readily accessible, remote signalling may provide operational, historical and diagnostic information, either as simple mains failure and battery low alarms, or as RS232 information to a signal panel, management system or UPS management package.

UPS/USER COMMUNICATION

Using opto-isolators or volt-free contacts, a UPS can be interfaced with the protected voice and data processing system so that system users are notified of changes in UPS operating status, and to achieve an orderly system shutdown on mains failure.

SERIALCOMMUNICATION

For more detailed remote information, RS232 transmitted data can be displayed on an alphanumeric panel, terminal or network PC. Communication can be achieved using a standard RS232, RS422 or RS485 serial line (twin pair connection).

NETWORK COMMUNICATION

For network wide management, a UPS can be managed using the SNMP– Simple Network Management Protocol. SNMP can be achieved using software or hardware solutions.

EUROPEAN TECHNICALSTANDARDS AND LEGISLATION

All UPS must bear the CE mark in compliance with the “73/23/EEC Low Voltage” and “89/336/EEC Electromagnetic compatibility” directives (and related amendments). UPS compliance with other Directives (for example those relating to construction projects and the machinery directive) is not required unless specifically requested by a customer. CEI, CENELEC and IEC are the recognised regulatory authorities at national, European and international levels. The following nationally recognised European UPS standards show conformity with the Directives and achievement of a CE mark.

SAFETY

EN 50091-1-1 (CEI 22-13) describes the basic safety requirements for UPS accessible by an operator

EN50091-1-2 (CEI 22-16) regulates UPS with limited accessibility - inside cabinets.

ELECTRO-MAGNETIC COMPATIBILITY

UPS operation must be unaffected by disturbances (immunity) and must not disrupt operation of downstream equipment (emissions), via electro-magnetic interference conducted along the mains cables from the UPS enclosure. The EN 50091-2 (CEI 22-9) standard refers to the related descriptions and test procedures.

PERFORMANCE

The BS EN 62040-3:2001 standard is designed to improve the understanding between UPS manufacturers and the power protection market place about the types of UPS available and their generic characteristics.

OTHER STANDARDS

Other standards relating to UPS installation include:
HD384/IEC364 (CEI 64-8) for electrical installations in general
CEI 11-20 for systems with UPS connected to class I and II networks
EN 60439-1/IEC439-1 (CEI 17-13) for control equipment
EN60529/IEC529 (CEI 70-1) for enclosure protection
EN50272-2 (soon to replace the CEI 21-6/3 standard) for battery installation