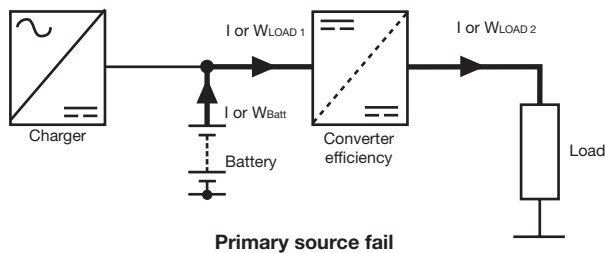
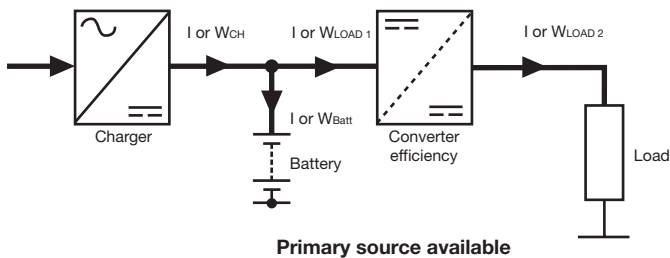


• DC Standby Systems

DC standby systems can be broken down into five sections as shown below:

- AC / Primary Power Source
- Rectifier / Charger
- Control / Management
- Battery
- Load Distribution

When designing a DC standby system it is important to always start at the load and work back to the AC source, taking into account the efficiency of any load voltage regulation devices such as DC/DC converters, step-up converters or diodes when sizing the battery.



Care should be taken as the load rating on the system may change when the primary source is not available, as this may change the battery Ah capacity required.

AC/Primary Power Source

The AC/Primary power source will typically be derived from the national power grid. For small installations, a single-phase supply will generally be sufficient. For large arrays of single-phase rectifiers or high current applications a three-phase supply may be more suitable.

Rectifiers/Chargers

Rectifier/charger designs are based around switch-mode technology, offering the advantage of being lightweight, robust and more compact than traditional transformer/thyristor based equipment.

Rectifiers/chargers should provide a regulated output, <1%, along with ripple of less than 1% (as excessive ripple will result in battery plate damage) and withstand variations on the incoming AC line voltage of at least $\pm 10\%$

Voltage & current protection circuitry, boost/equalizing charging, and temperature compensation will commonly be incorporated, in addition to remote control and alarm reporting.

Batteries

The most important part of the DC power system is the battery. A full section of this guide is given to battery sizing and selection. See pages 18-20 in the *Input Considerations* section.

Control and Monitoring

Remote control and monitoring facilities are often provided on DC standby systems to provide the user with real-time information concerning the ability of the system to provide back-up power. Power management functions such as on-line/off-line charging, low voltage disconnect and charger current control can be designed into the system to give a high level of functional independence and high levels of redundancy.

Care should be taken not to overcomplicate the control and monitoring systems in a particular application. While it may be advantageous to be able to establish the remaining battery capacity in large telephone exchange systems, this level of complexity would not normally be required on a fire/intruder alarm back-up unit.

The following features should be considered on most systems:

Temperature Compensation

The simplest way of maintaining the rate of reaction within a battery while charging. The charge voltage is adjusted at a rate proportional to the change in temperature (i.e reduce charge voltage for increase in ambient temperature). A typical change in charge voltage is $-3\text{mV}/^\circ\text{C}$ for a VRLA battery. This will maximize battery life and protect against thermal runaway.

Low Voltage Disconnect

When using VRLA batteries, care should be taken not to over-discharge the battery below $1.65\text{V}/\text{Cell}$, in order to avoid permanent damage to the battery. This can be achieved by either disconnecting the battery or load from the system by tripping the battery/load MCB (manual reset), or by opening a contactor/relay (automatic reset).

Battery Protection

Unlike with most other DC power sources, batteries do not have any built-in current-limiting devices, so if short-circuited the current available from a battery will be limited only by the battery's internal resistance and any components connected between the battery and the short (cable, terminals etc).

This current may be greater than 100 x the operating system current, resulting in damage to cable insulation or even fire within the system. This current needs to be interrupted before it can do any damage. The best way to do this is to include within the system suitably-rated battery fuses or MCBs sized to break these high DC currents (battery protection should be fitted as close to the battery terminals as is practically feasible).

Distribution

DC power distribution is generally achieved by using circuit breakers or fuses, sized to allow either manual or automatic interruption to current flow under overcurrent fault condition.

When designing secure power systems or routing cables carrying both AC and DC, lead inductance and coupling of noise into the DC distribution system may cause problems in some installations.

Inadequate sizing of conductors and interface points to bus-bars and other components may result in an appreciable voltage drop at the load.

System Sizing

In order to size any DC system there is a minimum of data required before you can start:

- System nominal voltage e.g. 24V, 48V, 110V.
- Load rating - either current or Watts drawn by the load during normal & primary power source failure.
- Standby time.
- Load voltage limits – the voltage range in which the load will safely operate.
- Normal operating/ambient temperature in which the battery will be operating.
- Battery type preferred, if known.
- Incoming supply parameters.