Emergency Power Systems

All facilities must have an emergency power system for life safety as required by code. It must be designed in accordance with NFPA 110, *Emergency and Standby Power Systems*. See Chapter 7: *Fire Protection Engineering* for additional requirements.
BatteriesSelf contained battery units may be used for individual light fixtures in buildings where an emergency generator is not required for other systems.

Fire alarm and security systems must be provided with their own battery back-up.

Generator Systems The system should consist of a central engine generator and a separate distribution system with automatic transfer switch(es), distribution panels, and 480/277V lighting panel (if applicable) with dry-type transformers feeding 208/120V panels as required.

Service Conditions. If the unit is to be installed outdoors, it should be provided with a suitable enclosure and have provisions to ensure reliable starting in cold weather. Starting aids such as jacket-water heaters can be specified to improve reliable starting capability in cold weather.
When installed at high altitudes or in higher-than-rated ambient temperatures, the unit must be derated in accordance with manufacturers' recommendations. Operation of starting batteries and battery chargers must also be considered in sizing calculations. In humid locations heaters can reduce moisture collection in the generator windings. Silencers are required for all generators. Acoustical treatment of the generator room shall be provided if necessary.

Generators should be located at least 30 m (100 feet) from communications frame equipment to avoid radio frequency interference. See Chapter 3: *Architectural and Interior Design, Space Planning, Building Support Spaces, Mechanical and Electrical Rooms, Emergency Generator Rooms* for additional generator room requirements.
Radiators should be unit-mounted if possible. If ventilation is restricted in indoor applications, remote installation is acceptable. Heat recovery and load shedding should not be considered.

Capacity. The engine generator should be sized to approximately 110 percent of design load; ideally it should run at 50 percent to 80 percent of its rated capacity after the effect of the inrush current declines. When sizing the generator, consider the inrush current of the motors that are automatically started simultaneously. The initial voltage drop on generator output due to starting currents of loads must not exceed 15 percent.
Emergency Power Loads. Emergency power should be provided for the following functions:

- **Egress and exit lighting**
- **Fire alarm system**
- **Generator auxiliaries**
- **Smoke control systems (if required by code)1**
- **Fire pump**
- **Lighting2**
- **Telephone switch**
- **Security systems**
- **Mechanical control systems**
- **Building Automation System (BAS)**
- **Elevators (one per bank)1**
- **Sump pumps**
- **Sewage ejector pumps**
- **Exhaust fans removing toxic, explosive or flammable fumes**
- **Uninterruptible power systems serving computer rooms1**
- **Air conditioning systems for computer and UPS rooms1**
- **Exhaust fan in UPS battery rooms**
- **Power and lighting for Fire Control Center and Security Control Center**
- **Lighting for main electrical room, electrical closets, and communications closets**
- **Air conditioning systems for communications closets**
- **Emergency power receptacles**
- **Horizontal sliding doors**
- **Other associated equipment designated by code**

Notes:
1 Evaluate on a case by case basis.
2 As noted in the Section: Lighting Criteria for Building Spaces of this chapter.
Distribution System. The distribution system should be designed so that emergency and auxiliary power sources cannot backfeed energy into the de-energized normal voltage systems under normal, emergency or failure conditions.
Generator Derangement Alarms. Generator derangement alarms must be provided in the generator room. All malfunctions should be transmitted to the BAS. In buildings without BAS, a generator alarm annunciator should be located within the fire command center.

Automatic Transfer Switches. Automatic transfer switches serving motor loads should be dual motoroperated (adjustable time delay neutral position) or have in-phase monitor (transfer when normal and emergency voltages are in phase) to reduce possible motor damage caused by out-of-phase transfer. They may also have pretransfer contacts to signal time delay relays in the emergency motor control centers.
In order to reduce possible nuisance tripping of ground fault relays, automatic transfer switches serving 3-phase, 4-wire loads should have 4-pole contacts with an overlapping neutral.

Automatic transfer switches should include a bypass isolation switch that allows manual bypass of the normal or emergency source to insure continued power to emergency circuits in the event of a switch failure or required maintenance.

Load Bank. Generally, generators should be run with the actual load connected. In selected applications where critical loads cannot tolerate a momentary outage, load banks may be considered.
Paralleling. For computer centers and other critical facilities, generator paralleling should be considered.
Fuel Distribution System. See Chapter 5: *Mechanical Engineering, Heating Systems, Boilers and Heat Exchangers*, for information on fuel oil piping and underground fuel oil tanks.