Generator Start-Up Time and Power Availability

A generator set is an **alternate power source.** The Philippine Electrical Code (PEC) defines **alternate power source** as one or more generator sets, or battery systems where permitted, intended to provide power during the interruption of the normal electrical services or the public utility electrical service intended to provide power during interruption of service normally provided by the generating facilities on the premises (Article 5.17.1.2).

The Philippine Electrical Code (PEC) categorizes the application of generator sets into 3 category:

1. **Emergency Systems** (Article 7.0)
2. **Legally Required Standby Systems** (Article 7.1)
3. **Optional Standby Systems** (Article 7.2)

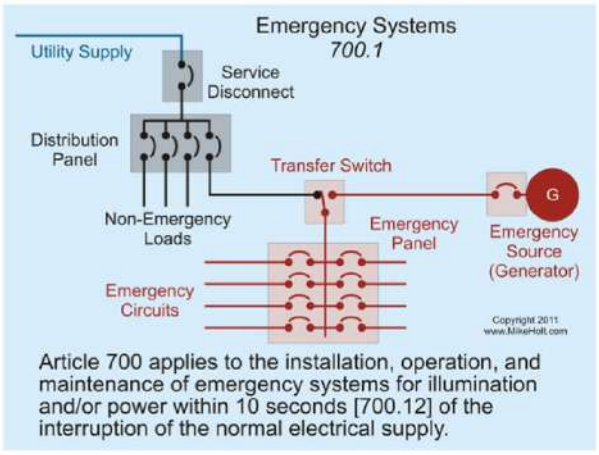
If the generator is installed in an "**Emergency System**" the generator is intended to supply alternate power to a limited number of prescribed functions vital to the protection of life and safety (Article 5.17.1.2). The generator in this type of application is intended to automatically supply power to **emergency loads** such as emergency lights, exit signs, fire pump, fire suppression system, public address system, sirens, and healthcare facility. Sometimes, it simply provides power for exit lighting and exit signs upon loss of main power or in the case of fire. Its purpose isn't to provide power for normal business operations, but rather to provide lighting and controls essential for human life safety (*NEC Requirements for Generators by Mike Holt*). If the normal source fail, generator installed for this type of application should be able to provide power to emergency loads **within 10 seconds** (Article 7.0.3.1).

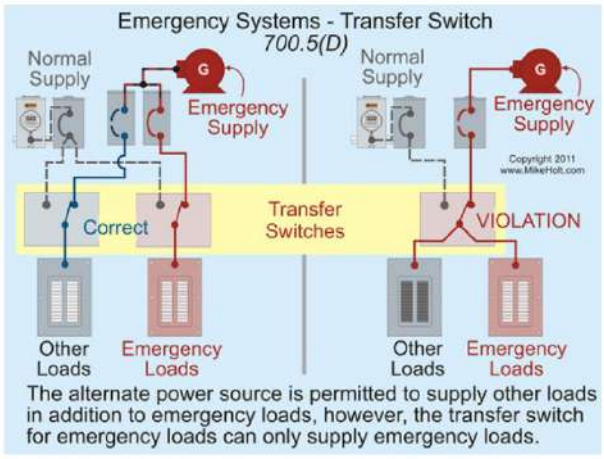
If the generator is installed in a "**Legally Required Standby System**" the generator is intended to automatically supply power to selected loads (other than those classed as emergency systems) in the event of failure of the normal source (Article 7.1.1.2). Selected load includes those **non-emergency loads** such as the normal lighting systems (not the emergency lights), heating and refrigeration systems, elevator, communication systems, ventilation and smoke removal systems, sewage disposal, and industrial processes, that when stopped during any interruption of the normal electrical supply, could create hazards or hamper rescue or fire-fighting operations. If the normal source fail, generator installed for this type of application should be able to provide power to non-emergency loads **within 60 seconds** (Article 7.1.3.1).

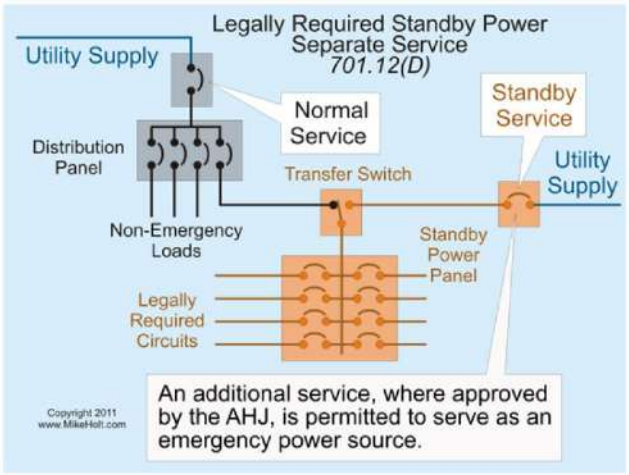
If the generator is installed in an "**Optional Standby System**" the generator is intended to supply power to public or private facilities or property where life safety does not depend on the performance of the system. Optional standby systems are intended to supply on-site generated power to selected loads either automatically or manually (Article 7.2.1.2). Selected loads may include heating and refrigeration systems, data processing, communication systems, and industrial processes that, when stopped during any power outage, could cause discomfort, serious interruption of the process, damage to the product or process, or

the like. If the normal source fail, **there is no defined generator start-up time** for this application (Article 7.2.4.1).

The following diagrams are excerpts from Mike Holt's Illustrated Guide to NEC Requirements for Generators and Standby Power Systems based on NEC 2011. Please note that PEC is based on NEC with the same context but with reassigned Article numbers.







The Effects of 10 Seconds Rule in an Emergency System

In most cases there is always something that is sacrificed in an emergency situation. As mentioned above, a generator in an Emergency System is expected to provide power to emergency loads within 10 seconds. In this period of time the diesel engine is rapidly started at high speed, also called “high speed cold start”. In high speed cold start, the combustion chamber of the diesel engine would not have enough heat to burn the fuel efficiently which leads into high emission of particulate matter (PM), carbon monoxide (CO), hydrocarbon (HC) and nitrogen oxide (NOx). The smoke opacity level also becomes high during this period resulting into a thick emission of smoke. The ignition delay period is extended and the risk of misfiring increases. Misfiring is the most critical problem during diesel engine cold start as it could cause serious emission and unstable combustion. The engine could also suffer from wet stacking, cylinder glazing and fuel injector fouling. Hence, both the engine and the environment that is being polluted is sacrificed in this 10 seconds period in an Emergency System. But at least, in an event of utility power failure, emergency power supply is provided to emergency loads needed to evacuate the building during an emergency such as earthquake or fire. Remember that in an Emergency System, human life and safety is given the importance rather than the generator’s engine.

The term “emergency generator” is often used mistakenly as a description of any type of generator used to provide power in a facility. However, it is important that the engineer review the code requirements when deciding on the classification of an alternate power source. When communicating with code officials, it is important to use the correct term – emergency or standby- and not mix up the two unless you have a system with both types of loads.

For more information read the Philippine Electrical Code (PEC): Generators (Article 4.45), Emergency Systems (Article 7.0), Legally Required Standby Systems (Article 7.1) and Optional Standby Systems (7.2).