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# THE NO-NONSENSE GUIDE TO NFPA 110 COMPLIANCE FOR EMERGENCY POWER SYSTEMS



**WARNING**  
**Buried  
Fuel  
Pipes**  
Locate before  
digging

## **UNDERSTANDING NFPA 110: ADVICE FOR INSTALLING AND MAINTAINING YOUR EMERGENCY POWER SYSTEM**

Power outages can mean more than lights out. For many facilities, an outage of even a minute can result in the loss of millions of dollars – or worse, put human lives at risk.

[National Fire Protection Association standard 110](#) – the standard for emergency and standby power systems – outlines requirements for the installation and performance of backup power systems in emergency and legally required applications, where an outage would pose a life safety risk.

In this guide, we'll explore what NFPA 110 is, and what to consider when implementing and maintaining your facility's emergency power system.

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**SECTION I:  
WHAT IS NFPA 110 –  
A BRIEF OVERVIEW**

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## WHAT IS NFPA 110: A BRIEF OVERVIEW

Split up into eight chapters and three annexes, the 2016 edition of NFPA 110 is intended to codify the performance – in installation, maintenance, operation and testing – of emergency and standby power systems.

Before launching into what NFPA 110 is and how it should – and shouldn't – be used by facility managers, installers, design engineers and manufacturers, we need to address a few key definitions used throughout the standard.

- **Emergency power supply (EPS)**

Essentially, the emergency power supply (EPS) is the source of electrical power (i.e., generator) used in your backup power system (3.3.3). It is independent of your primary source of power, ready to kick on in case of power failure. Within the confines of this particular guide, when we refer to an EPS, we are talking about a standby generator.

- **Emergency power supply system (EPSS)**

Your emergency power supply system (EPSS) refers to your functioning backup power system in its entirety. It includes the EPS, transfer switches, load terminals and all the equipment required to provide a safe and reliable alternative source of power for your facility (3.3.4).

- **Authority having jurisdiction (AHJ)**

Authority having jurisdiction (AHJ) is a broad term referring to the agency or agencies responsible for enforcing code compliance in your particular city or region (3.2.2).

- **Approved**

NFPA 110 defines something as approved when it's "acceptable to the AHJ" (3.2.2).

This is important: The NFPA doesn't approve any equipment or installations as being "compliant" with NFPA 110 (A.3.2.1).

The only way to guarantee your installation, procedures or equipment are compliant is to work with your AHJ to ensure it aligns with all applicable standards, policies and codes, while referencing this standard and your manufacturer's recommendations.

These terms are at the core of NFPA 110. Essentially, the standard provides requirements and best practices for the setup and ongoing performance of EPSS's to ensure they are able to provide prompt and reliable power in the event of the failure of your primary power source, minimizing the risk to human life.



## The keys to understanding NFPA 110: Level, Class and Type

The key to understanding the requirements outlined in NFPA 110 lies in acquainting yourself with the way emergency power supply systems (EPSS) are classified: By Level, Class and Type.



### **Level**

*Dictates performance standards your system needs to follow.*



### **Class**

*Duration your system must be able to run without refueling.*



### **Type**

*Time your generator has to get up and running after a failure.*

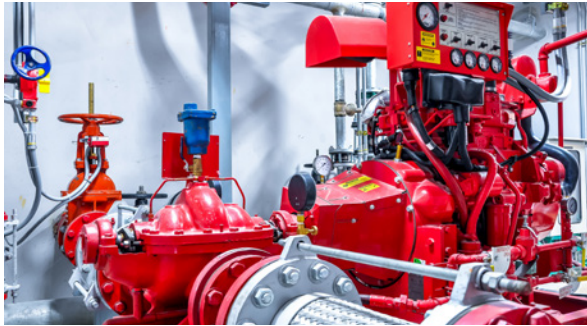
These categories dictate decisions including (but not limited to) what equipment to use, where to store the system and how much fuel to keep on site as required by your facility's application, location, proximity to fuel and level of life safety risk.

## Level

There are two EPSS levels defined in the standard: Level 1 and Level 2. They're distinguished by the types of loads they carry, and have different equipment and installation standards.

Level 1 EPSS systems provide power where failure would result in "loss of human life or serious injuries" (4.4.1). Level 2 EPSS systems carry loads "less critical to human life and safety" (4.4.2). As you can imagine, Level 1 EPSS systems are subject to stricter design guidelines. Most equipment is designed for Level 1 requirements, and can be used for the less strictly regulated Level 2 loads.

It's important to note that NFPA 110 does not state which applications, specifically, qualify as Level 1 or Level 2 – that is up to the AHJ's interpretation (1.1.5). They do, however, provide some examples of situations where a Level 1 or 2 EPSS might be required.



### **Possible NFPA 110 Level 1 applications**

Life safety illumination, public safety communication systems, fire pumps (pictured above) and ventilation equipment (A.4.4.1).



### **Possible NFPA 110 Level 2 applications**

Heating and refrigeration systems (pictured above), sewage disposal and some industrial processes (A.4.4.2).

NFPA 110 only defines systems with a direct impact on life safety – even the failure of a Level 2 system would have significant ramifications for occupants if it failed (1.1.3). Due to the effect of Level 1 and 2 loads on life safety, NFPA EPSS systems must be permanently installed to ensure it kicks on in case of your primary power source's failure.

As you're likely well aware, there are certain non-essential applications (i.e., data centers, research facilities) where failure could result in the loss of millions of dollars. These types of loads would be served by optional standby generators, which aren't defined in NFPA 110 because they aren't essential to life safety.

Facility managers looking for compliance guidance for a necessary (but not legally required) unit should turn to NFPA 70, more commonly referred to as the National Electrical Code®. Article 702 contains helpful information regarding the design and installation of optional standby power systems.



Actually, there is quite a bit of overlap between the NEC® and NFPA 110. NFPA Level 1 roughly equates to Article 700 for “emergency systems,” and Level 2 to Article 701 for “legally required standby systems.”

 **Class**

Your EPSS Class is the duration (in hours) your system must be able to run at its full-rated output without refueling (4.2).

Class 2 requires your gen set run for 2 hours without adding fuel, Class 48 requires 48 hours and so on. Although some AHJ’s define “Class X” differently, it generally translates to 96 hours of rated output.

**Table 4.1(a) Classification of EPSSs**

<b>Class</b>	<b>Minimum time</b>
Class 0.083	0.083 hr (5 minutes)
Class 0.25	0.25 hr (15 minutes)
Class 2	2 hr
Class 6	6 hr
Class 48	48 hr
Class X	Other time, in hours, as required by the application, code, or user

*Source: NFPA 110*

Higher Classes pose a challenge for system designers – especially designers of larger systems – as you must have enough fuel stored on site to satisfy your gen set’s fuel consumption for the duration as defined by your Class. Let’s say you require 18,000 gallons of fuel to run your EPS for 96 hours because you have a Class X EPSS installation. According to the 133% rule, you need to store almost 24,000 gallons on site.

You'll need to carefully size your fuel tanks and perform regular fuel maintenance to ensure compliance (7.9). You should also consider fuel supplier delivery logistics — if you're in a rural area where it's going to take a while to get more fuel if you run out, you might consider oversizing your tank even further.

You should work closely with your gen set manufacturer to come up with a fuel storage and maintenance plan that complies with this standard and all applicable codes, without being cost prohibitive.

### Type

Type refers to the time (in seconds) your system has to be up, running and carrying your Levels 1 and 2 loads. For emergency power — defined as Level 1 in NFPA 110 — 10 seconds is the standard. That means all Level 1 loads need to be transferred to your EPSS in 10 seconds, no matter how large or small your system is.

To prevent nuisance starts, there's usually a time delay of about 1 to 3 seconds on the transfer, leaving even less time to move the load. With bigger units, the time delay is sometimes reduced to buy more time for the transfer. For instance, a time delay of 3 seconds give 7 seconds for the transfer. Reducing the delay to 1 second gives 2 more seconds to transfer the load, which could be critical for larger applications.

You need your EPSS to kick on within a reasonable timeframe after power failure — and you need it to fulfill your load requirements in full until your primary power source comes back on.

And that's what NFPA 110's classification method was designed to do: Ensure your

**Table 4.1(b) Types of EPSSs**

<b>Designation</b>	<b>Power restoration</b>
Type U	Basically uninterruptible (UPS system)
Type 10	10 sec
Type 60	60 sec
Type 120	120 sec
Type M	Manual stationary or nonautomatic – no time limit

Source: NFPA 110

EPSS system will provide a “source of electrical power of required capacity, reliability and quality” for the timeframe your application requires (4.1).

## A few important caveats about NFPA 110

While it provides guidance to design engineers, manufacturers and governing agencies, NFPA 110 is not an all-encompassing manual for the design and implementation of emergency power systems.

In fact, NFPA 110 dedicates a whole chapter to listing out referenced publications and standards “considered part of the requirements of [the] document.” The publications listed on the next page might be useful in your continued research regarding compliance for your emergency power systems for your facility.

- [NFPA 1](#) – Fire code
- [NFPA 30](#) – Flammable and combustible liquids code
- [NFPA 37](#) – Standard for the installation and use of stationary combustion engines and gas turbines
- [NFPA 54](#) – National fuel gas code
- [NFPA 58](#) – Liquefied petroleum gas code

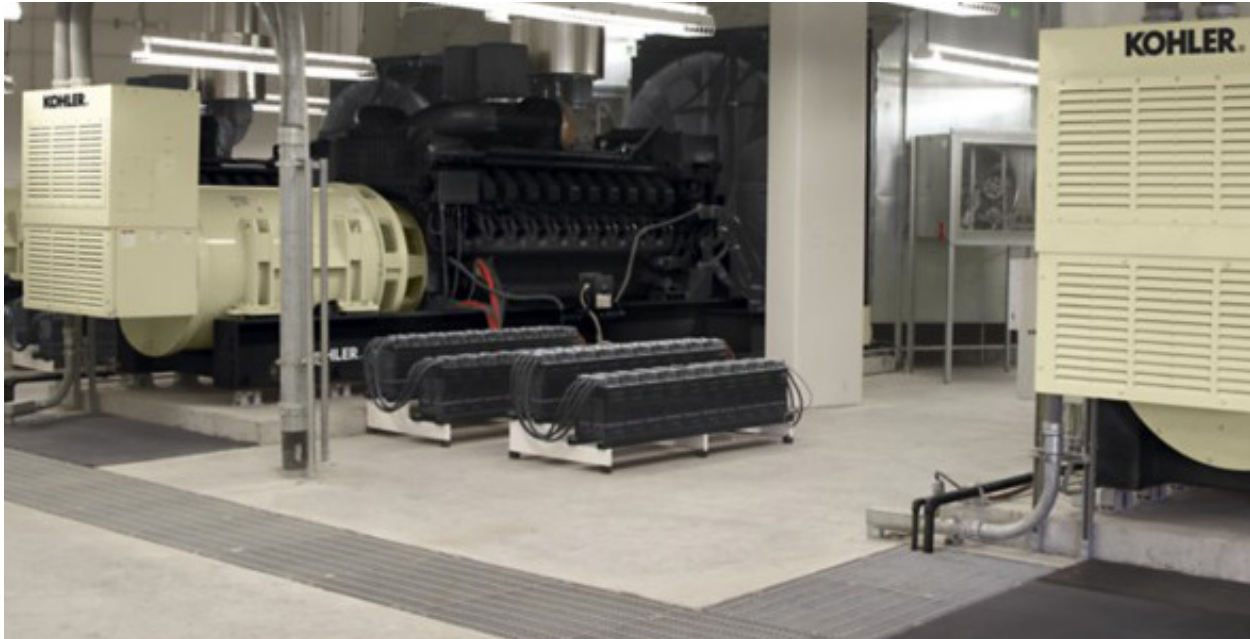
- [NFPA 70®](#) – National electrical code®
- [NFPA 72®](#) – National fire alarm and signaling code
- [NFPA 99 \(if applicable\)](#) – Health care facilities code
- [NFPA 780](#) – Standard for the installation of lightning protection systems
- [ASCE / SEI 7](#) – Minimum design loads for buildings and other structures

To ensure your system is compliant, you'll need to reference all applicable codes and standards in your area and work closely with all AHJ's. By familiarizing yourself with the necessary codes – and working with the appropriate state and federal authorities to certify your emergency power system – you can be sure your backup emergency power will kick on when you need it most.



The background of the page is a photograph of an industrial facility, likely a power plant or manufacturing plant, with various pieces of machinery and pipes. The entire image is overlaid with a semi-transparent red filter. The text is centered in the upper half of the image.

**SECTION II:  
ACHIEVING NFPA  
COMPLIANCE – WHAT YOU  
NEED TO KNOW**



Emergency power systems aren't called upon in ideal situations. And your EPSS needs to be designed to kick on in flood, earthquake, fire and storm conditions (A.5.1.1).

NFPA 110 outlines ways to prevent the disruption of life safety critical loads in case of emergency and outlines the tests required to prove compliance with your AHJ. But your EPSS will ultimately be installed, tested and maintained by your gen set manufacturer and "approved" by your AHJ.

And because your particular AHJ will vary depending on your location, there's no cut-and-paste way to achieve compliance. You'll need to carefully read NFPA 110 and talk with your AHJ to make your EPSS installation is compliant with all applicable standards and codes.

Your generator manufacturer — if familiar with NFPA 110 — is another excellent resource to lean on throughout your journey to compliance. At CK Power, our system engineers are well-versed in NFPA 110, and other applicable standards, and can assist you in achieving compliance for your emergency power system.

Through every stage of the EPSS approval process — design, installation, maintenance and testing — our engineers will be on your side, offering cost-effective, compliant solutions tailored to your particular application. They'll also consider applicable codes, standards and requirements beyond NFPA 110 in the development of your maintenance and testing plan.

From design to ongoing maintenance, there's a lot to think about when seeking to comply with NFPA 110. We're going to take you through highlights of each step of the process, so you can know the right questions to ask and things to consider when developing a code-EPSS with your generator manufacturer.

## Installation acceptance testing

Your EPSS is not considered compliant upon installation — you must prove its function and ability to carry all emergency loads (7.13.1) through a series of on-site installation acceptance tests and a two-hour load test (7.13.4.3).

Along with assistance from your generator manufacturer, you'll test your EPSS installation and ensure it both follows NFPA guidelines and is acceptable to your AHJ. After passing the tests, your equipment will be warranted and commissioned by your AHJ for use as an emergency power system.



## Routine maintenance according to NFPA 110 Chapter 8

Your EPSS must provide reliable power at a moment's notice. And since you can't predict when you'll need to call upon your emergency power system, routine maintenance and testing is the only way to make sure the system is functioning and ready to kick on at all times.

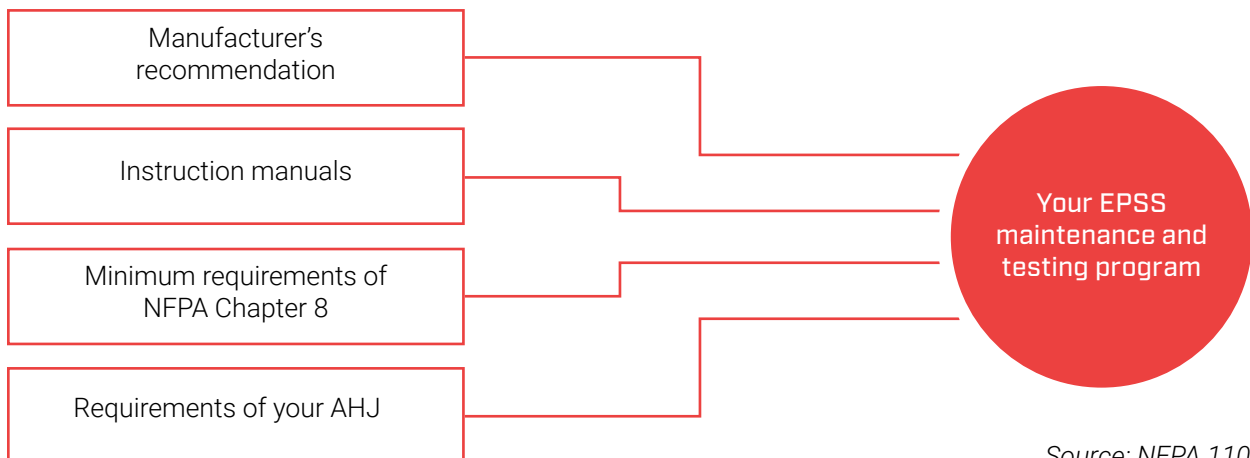
NFPA 110 Chapter 8 [suggests you follow your manufacturer's maintenance recommendations](#), but outlines an alternate maintenance program if no manufacturer-given guidelines are available (A.8.3.1). This sample EPSS maintenance plan is provided in [Figures A.8.3.1\(a\) and A.8.3.1\(b\)](#).

Their alternative recommendations are helpful in visualizing the weekly, quarterly, monthly and annual inspection / maintenance items you'll have to perform. However, it isn't necessarily an exact replica of what your plan will look like. And following it won't guarantee compliance – the NFPA only provides the sample plan for informational purposes.

Your particular system's maintenance program will depend largely on your manufacturer's recommendations and your AHJ's requirements. Maintenance is a big part of what we do at CK Power.

We'll help design a maintenance program to overcome your facility's particular challenges, such as storing / maintaining your fuel supply and ensuring the continued integrity of your system's transfer equipment.

### Core elements of an EPSS maintenance program



Source: NFPA 110



## Ongoing emergency power system testing

You'll need to perform a weekly inspection and a monthly load test on your EPSS (8.4.1). And every 36 months, you'll need to run Level 1 EPSS for the amount of time specified in your application's Class up to four hours of runtime (8.4.9.1-2).

The purpose of these tests are to periodically verify the function of the system against the standard. To achieve compliance, however, you'll need to consult your AHJ and manufacturer to develop an acceptable testing program for your system.

If you're trying to achieve compliance for your facility's emergency power system, closely reading NFPA 110 is a good place to start. From there, you'll need to work with the governmental agencies responsible for code enforcement in your area. And along the way, your generator manufacturer should be able to answer any questions you might have about the installation, maintenance, operation and testing of a compliant NFPA EPSS.

## LET'S TALK

CK Power is a leading supplier of generators for both prime and standby applications. Our staff of engineers and compliance specialist helps our customers choose and maintain the equipment that's right for them – and helps facility managers achieve compliance. With NFPA 110 compliance specialists on staff, CK Power can design, install and maintain even the most complex emergency power systems within code.

Visit our [maintenance programs page](#) for more information on what goes into a planned service agreement, or get in touch with CK Power today to discuss your emergency power needs.

### Contact us with any questions

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