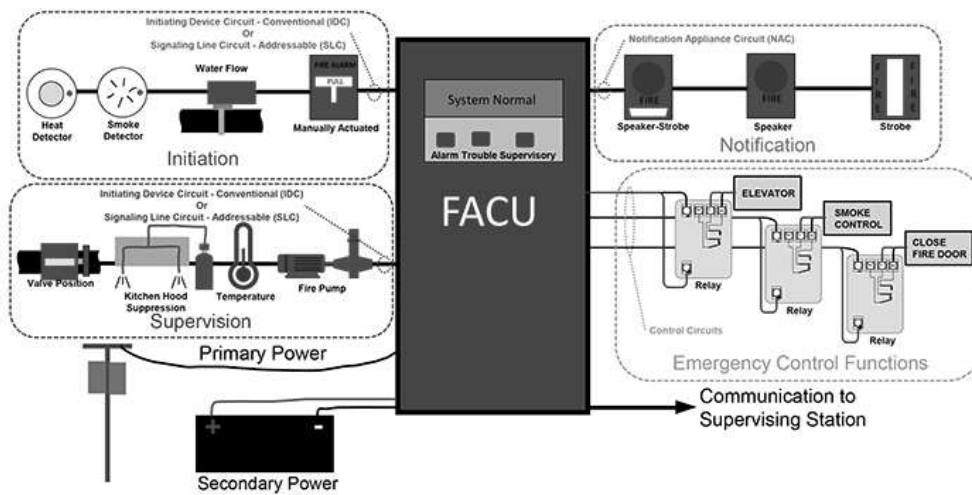**This information is provided by CSA for general study and explanation of concepts. CSA is not liable for accuracy and has not validated all information. User assumes risk for accuracy.**

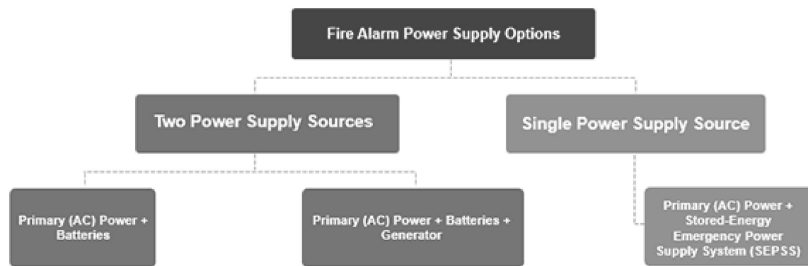# Guide to Fire Alarm Basics: Power Supplies

By Shawn Mahoney
25-Oct-2021

A fire alarm system is a crucial part of the overall fire protection and life safety strategy of a building. A fire alarm system serves many functions and the differences between the functions can be a bit confusing, so I created a visual guide to fire alarm basics. The objective of this blog series is to discuss some of the major components and functions of a fire alarm system. For an overview of the entire system take a look at my Guide to Fire Alarm Basics Blog. This blog will take a deeper dive into fire alarm power supplies.
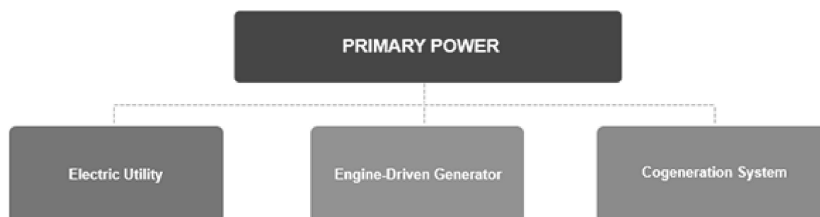
It is important for a fire alarm system to be provided with reliable power so it can operate during any emergency. There are a few different options when it comes to choosing a reliable power supply, as well as some calculations that are necessary to ensure that the fire alarm system is provided with sufficient backup power.
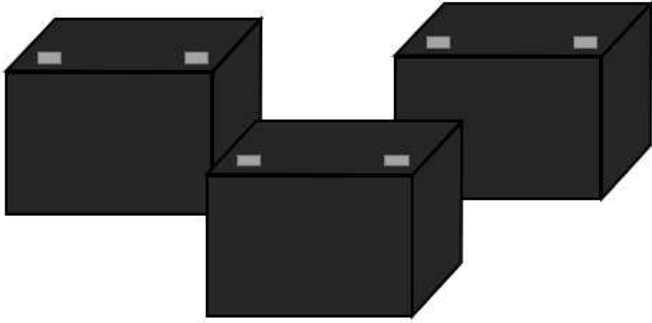
Power Supply Options

There are a few different options out there when it comes to providing a reliable power source. They include providing an additional power source in addition to the primary power such as batteries or an emergency generator so there is backup power if primary power is lost or providing power through a single source such as a Stored-Energy Emergency Power Supply System (SEPSS).
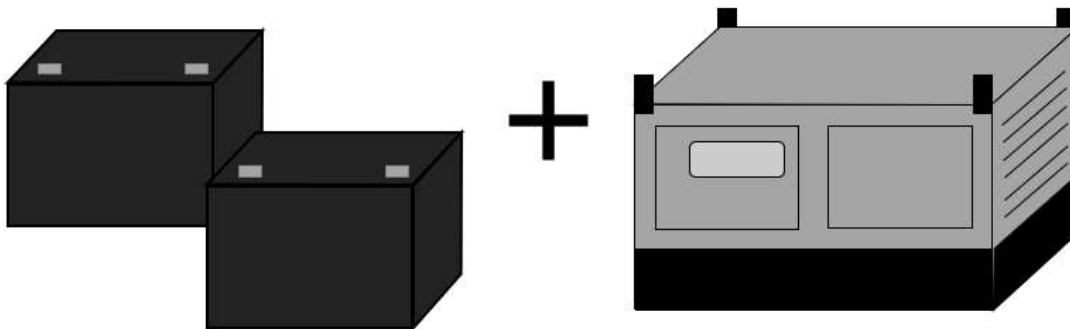
Primary Power

Primary power to the fire alarm system can be provided by the electric utility, an engine-driven generator (this is not a standby generator, however it is a site generator meeting the requirements in NFPA 72), and Stored-Energy Emergency Power Supply System (SEPSS), or a cogeneration system.

Batteries

Batteries are a common way to provide a secondary power supply, the most common type of battery is a Valve-Regulated Lead-Acid battery and they are typically located within the fire alarm control unit enclosure, or in a separate battery box located near the fire alarm control unit. Batteries need to be sized so that they can provide power to the entire fire alarm system for 24 hours in standby and 5 minutes in alarm, if the system is an emergency voice alarm communication system (EVACS), then the batteries need to provide capacity for 15 minutes in alarm in addition to the 24 hours in standby. The additional time is required to allow for a longer evacuation time as buildings with an EVACS typically utilize a partial evacuation that would require constant communication with the occupants during the evacuation.
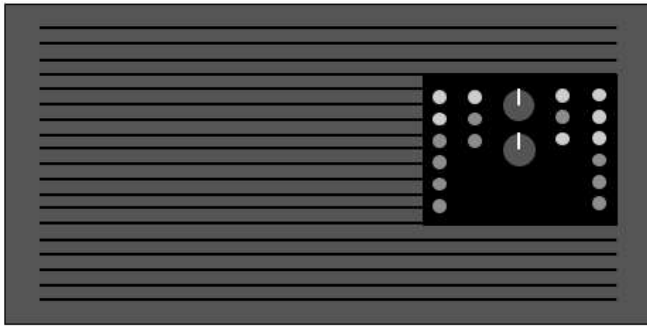
Batteries and Generator

Another common way of providing a secondary power supply for a fire alarm system is the use of an emergency generator designed, installed, and maintained in accordance with NFPA 110, Standard for Emergency and Standby Power Systems, which provides power to the fire alarm system through an automatic transfer switch. If using an emergency generator, you are still required to provide batteries as well just in case there is an issue with getting the emergency generator started. These batteries however, only need to provide a capacity for 4 hours instead of the 24 hours in standby.

Stored-Energy Emergency Power Supply System (SEPSS)

Instead of providing two separate power supplies, you are permitted to provide power via a Stored-Energy Emergency Power Supply System (SEPSS) otherwise known as an Energy Storage System (ESS) or an Uninterruptible Power Supply (UPS). The SEPSS must be configured in accordance with NFPA 111 and provide 24 hours of backup battery. The SEPSS is also fed via a compliant primary power supply such as utility power or an on site generator.

Battery Calculations

1

Item	Standby Current (AMPS)	QTY	Total Standby Current (AMPS)	Alarm Current (AMPS)	QTY	Total Alarm Current (AMPS)
Fire Alarm Control Unit	0.1	1	0.1	0.2	1	0.2
Smoke Detector	0.001	4	0.004	0.05	4	0.2
Horn Strobe	0	10	0	0.075	10	0.75
Total System Standby Current (AMPS)			0.104	Total System Alarm Current (AMPS)		1.15

2

Required Standby Time (HRS)	X	Total System Standby Current (AMPS)	=	Required Standby Capacity (AMP-HRS)
24	X	0.104	=	2.496

Required Alarm Time (HRS)	X	Total System Alarm Current (AMPS)	=	Required Alarm Capacity (AMP-HRS)
0.083 (5 mins)	X	1.15	=	0.095

3

Required Standby Capacity (AMP-HRS)	+	Required Alarm Capacity (AMP-HRS)	=	Total Capacity (AMP-HRS)	X	Safety Factor (25%)	=	Required Battery Capacity (AMP-HRS)
2.496	+	0.095	=	2.59	X	1.25	=	3.24

As noted above, if batteries are part of the secondary power source for a fire alarm system then they must be sized to provide capacity to run the system for 24 hours in standby and then either 5 minutes in alarm or 15 minutes in alarm for EVACS. A simple calculation for a basic fire alarm can be seen above.

1) First the total system standby current and the total system alarm current is calculated. This is done by multiplying the standby current and alarm current for each piece of equipment by the total quantity of each piece of equipment and adding them together, the result is the total AMPS required in standby and alarm. Both the standby current and the alarm current for equipment can be found from the manufacturer in the data sheet.

2) Next total standby capacity is required by multiplying the total system standby current by the required 24 hours to achieve the required standby capacity in AMP-HRS. The same is done with the alarm capacity, however, instead of 24 hours, the current is multiplied by either 5 minutes (0.083 hours) or 15 minutes (.25 hours) to achieve the required alarm capacity in AMP-HRS.

ally, both the standby capacity and the alarm capacity is added together and a 25% safety factor is applied to arrive at the total required battery capacity.

Want to Learn More?

Like I noted in the beginning of this blog, if you are interested in learning more about fire alarm basics, take a look at my Fire Alarm Basics Blog. If you found this article helpful, subscribe to the NFPA Network Newsletter for monthly, personalized content related to the world of fire, electrical, and building & life safety.

Fire Alarm Basics Fact Sheet

Download Now!

Shawn Mahoney

NFPA Technical Services Engineer

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Top ⌄   🔍

NILDA   2 days ago
Hi Sir,
Can we use NI Cad batteries as back up in our Fire Suppression Panel

👍 0 👎 0   Reply

Keith Listebarger   6 months ago
HI Shawn, Does utility and back up generator account for two power sources or do you still need battery back up? Thanks,

👍 0 👎 0   Reply

Zane   2 months ago

I believe the utility would serve as the primary power source and that the emergency generator would account for the secondary power source. However, 4hrs of battery capacity are still required to power the fire alarm/ECS in case the engine-driven generator fails to start, allowing time for the generator to be serviced or repaired (see Section 10.6.7.3.1 (2)).

👍 0 👎 0   Reply

Matt Shealy   6 months ago

As NFPA 70 reads, for a CO2 detection system (6.8.2) when emergency power is required shall meet the requirements for a level 2 system in accordance with 110/111. Is it the AHJ that determines when it's required? Is it a 90 min backup system or 24hrs?

👍 0 👎 0   Reply

Steve   9 months ago

Hello, does NFPA 72 have any specific requirements for initiating another 24 hour battery test for T.I. work done to an existing fire alarm system.. Thank you.

👍 0 👎 0   Reply

Timothy Fleisher   10 months ago

Are there any exceptions in the code that allow an audible alarm to be silenced (strobes remain active) by tenants in a specific area of a building?

👍 0 👎 0   Reply

> **Shawn Mahoney**   10 months ago
>
> Take a look at 10.12 of NFPA 72, there are allowances however you need to deactivate both audible and visual and if you are only deactivating portions you need to document it in the emergency plan that needs to be approved by the AHJ.
>
> 👍 0 👎 0   Reply

jawed   1 year ago

please details about power supply unit 24 v DC 220 V AC

👍 0 👎 0   Reply

Scott   1 year ago

Do fire alarm booster panels in commercial buildings in Boston need to be fed from emergency power if they are equipped with battery back up?

👍 0 👎 0   Reply

archishman lahiry   2 years ago

I am new to fire alarm panels . Can someone provide me a basic layout/connection diagram for a honeywell n16e fire alarm panel and how to hook up 6 initiating devices and 4 horn-strobes. I will be installing it in a container with dimensions 19' X 8' X 11' ? Also Can someone tell me how much honeywell notifier N16e panel cost approximately ?

👍 0 👎 0   Reply

Cyril Varghese   2 years ago
Hi, Shawn,

Can we use NI-cd batteries instead of VRLA batteries?

👍 0 👎 0   Reply

> **Vivek P**   2 years ago
>
> Yes, reason: Ni-Cd batteries offer good cycle life and capacity, meaning they can be recharged more times than lead-acid batteries before battery cell failure occurs.
>
> 👍 0 👎 0   Reply

Andrew Kauffman   2 years ago

This sounds dumb to ask probably. Anyway is the power calculation for devices given for a one hour run time and that's why time and amp hours math works out in the end?

👍 0 👎 0   Reply

> **Shawn Mahoney**   2 years ago

Not a dumb question at all, the power requirement for the devices is given in amps, which is a measure of current or flow. We then multiply the amps by the run time in wither standby (24 hours) or Alarm (5 or 15 minutes (0.08 hours or 0.25 hours)) to get the total required battery capacity in Amp-Hours

👍 0 👎 0 Reply

Andrew Kauffman 2 years ago

Thank you for getting back to me Shawn! I understand how to perform the given equation. My question was more literal. I did more research after you answered and now understand. I wasn't aware that the definition of a ampere did include a measurement of time by the second. Which is why we can use time in the formula. The other aspect that I now grasp is the fact that amp hour rating given by the manufacturer is a measurement that they give to you that has the smallest form of measurement (seconds) taken into account. So us end users don't have to break the equation down to its simplest form in order to arrive at our conclusion needed for system design. In conclusion time is a unit of measurement by definition of an amp. Thanks again

👍 1 👎 0 Reply

Mark Watzke 2 years ago

Can 2 preaction system compressors share power with FACP?

👍 0 👎 0 Reply

Shawn Mahoney 2 years ago

Mark, the branch circuit supplying the FACU cannot supply any other loads.

👍 0 👎 0 Reply

Jeffrey Smith 2 years ago

I am unable to find any reference around a second utility feed being approved for the secondary power source of a protect premises fire alarm system. Is this not allowed or is it such a rare design that the Code doesn't consider it?

👍 0 👎 0 Reply

Guest 2 years ago

Rare design? It's not an appropriate design, just buy a pair of appropriate batteries.

👍 0 👎 0 Reply

Jeffrey 2 years ago

My application is not as simple as a pair of batteries, I'm trying to eliminate several hundred batteries across a campus. A unic application that is leading to more of an AHJ approval over code compliance. Thanks to all for their feedback.

👍 1 👎 0 Reply

Shawn Mahoney 2 years ago

In order to be considered secondary power, it would have to be an entirely separate utility feed that uses separate transmission lines as well as a separate power generation source. This is very rare and because of this it is not considered by the code, if you used something like this it would need to be approved by the AHJ.

👍 0 👎 0 Reply