

**51st
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**Emergency Power
Standards for Health Care
Under 2012 Codes**

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NFPA Disclaimer

- Although the speaker is Chairman of the NFPA Technical Committee on Emergency Power Supplies, which is responsible for NFPA 110 and 111, **the views and opinions expressed in this presentation are purely those of the speaker and shall not be considered the official position of NFPA or any of its Technical Committees and shall not be considered to be, nor be relied upon as, a Formal Interpretation.** Readers are encouraged to refer to the entire texts of all referenced documents.
- NFPA members can obtain staff interpretations of NFPA standards at www.nfpa.org.

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Learning Objectives

- List the main requirements of NFPA 110-2010 & NFPA 111-2010
- Describe improvements from pre-2000 to 2010 editions of NFPA documents and how they relate to existing accreditation requirements
- Explain the rationale behind the evolution of the content in NFPA 110 & 111
- Explain major changes and clarifications in NFPA 110-2013 and NFPA 111-2013 that will assist in future accreditation activities

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NFPA 101-2012: Life Safety Code®

- **7.9.2.4** Emergency generators providing power to emergency lighting systems shall be installed, tested, and maintained in accordance with NFPA 110, *Standard for Emergency and Standby Power Systems*. Stored electrical energy systems, where required in this Code, other than battery systems for emergency luminaires in accordance with 7.9.2.5, shall be installed and tested in accordance with NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*.
- **9.1.4 Stored Electrical Energy Systems.** Stored electrical energy systems shall be installed, tested, and maintained in accordance with NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*.
- **9.1.3.1** Emergency generators and standby power systems shall be installed, tested, and maintained in accordance with NFPA 110, *Standard for Emergency and Standby Power Systems*.
- *References 2010 editions*

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NFPA 99-2012: Health Care Facilities Code

- References: NFPA 110-2010 & NFPA 111-2010.
- Numerous mandatory extracts from NFPA 110-2010
- **6.4.4.1.1.3** Maintenance shall be performed in accordance with NFPA 110
- **6.4.4.1.1.4 Inspection and Testing.** Criteria, conditions, and personnel requirements shall be in accordance with 6.4.4.1.1.4(A) through 6.4.4.1.1.4(C).
 - ... Generator sets serving essential electrical systems shall be tested in accordance with NFPA 110, *Standard for Emergency and Standby Power Systems, Chapter 8.*"
- **6.4.4.1.3 Maintenance of Batteries.** Batteries for on-site generators shall be maintained in accordance with NFPA 110

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NFPA 99-2012: Health Care Facilities Code

- **6.6.4.1.1.3 Stored Energy Power Source.** Maintenance and testing of stored energy power supply systems shall be in accordance with NFPA 111 ... *Section 6.1 - 6.4.5*
- **15.5.1.2 Electrical Systems.** Electrical wiring and equipment shall be in accordance with *NFPA 70, ... unless such installations are approved existing installations*, which shall be permitted to be continued in service. [**101:9.1.2**]
- **15.5.1.3 Emergency Generators and Stand by Power Systems.** Emergency generators and standby power systems, where required for compliance with this code, shall be installed, tested, and maintained in accordance with NFPA 110
- **15.5.1.4 Stored Electrical Energy Systems.** Stored electrical energy systems shall be installed, tested, and maintained in accordance with NFPA 111 [**101:9.1.4**]

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NFPA 70-2011: National Electrical Code®

- **700.1 Scope.**
 - Informational Note No. 4: For further information regarding performance of emergency and standby power systems, see NFPA 110-2010
- **700.3 Tests and Maintenance**
 - Informational Note: For testing and maintenance procedures of emergency power supply systems (EPSSs), see NFPA 110-2010
- **708.21 Ventilation.** Adequate ventilation shall be provided for the alternate power source for continued operation under maximum anticipated ambient temperatures.
 - Informational Note: NFPA 110-2010 & NFPA 111-2010 include additional info on ventilation air for combustion and cooling.

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Major 110 Changes in 2013

- **Fuel oil – ASTM, maintenance, storage, tanks, quality, sampling, testing**
- Relaxed 96 hr seismic language
- Testing
- NFPA 70B Reference



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Major Changes in NFPA 110: 1999 to 2010

Category / Topic	1999 Edition (Ref. by 2000 LSC)	2010 Edition (Ref. by 2012 LSC)	2013 Edition
Loading percentages and testing time frames	Absolute units (25%, 30%, 50%; 30 minutes, etc.)	“Not less than” (NLT) clarification language added throughout	SAME
Testing after repairs	Required	Required; detailed instructions included, transfer all ATS’s for NLT 30 minutes	SAME

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Major Changes in NFPA 110: 1999 to 2010

Category / Topic	1999 Edition (Ref. by 2000 LSC)	2010 Edition (Ref. by 2012 LSC)	2013 Edition
Installation Acceptance Test	Difficult to follow time sequencing	Major rewrites for clarification	SAME
First routine test	Not really stipulated, could be next monthly	Immediately after passing acceptance tests	SAME
Types of records	Written record	Permanent record	SAME

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Major Changes in NFPA 110: 1999 to 2010

Category / Topic	1999 Edition (Ref. by 2000 LSC)	2010 Edition (Ref. by 2012 LSC)	2013 Edition
Stipulated generator maintenance	None stated. All EPSS per manufacturer. Suggest Annex if no mfr.	SAME	SAME, but also references NFPA 70B for info
Stipulated ATS maintenance	Basic All EPSS per manufacturer.	No change; Major annual PM in Annex	SAME, but also references NFPA 70B for info

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Major Changes in NFPA 110: 1999 to 2010

Category / Topic	1999 Edition (Ref. by 2000 LSC)	2010 Edition (Ref. by 2012 LSC)	2013 Edition
Stipulated paralleling gear maintenance	None stated. All EPSS per manufacturer.	Similar to ATS stipulated maintenance	SAME, but also references NFPA 70B for info
Stipulated battery maintenance	Weekly inspections; follow manufacturer's specs	Also permits battery conductance testing in lieu of specific gravity	SAME, but also references NFPA 70B for info

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Major Changes in NFPA 110: 1999 to 2010

Category / Topic	1999 Edition (Ref. by 2000 LSC)	2010 Edition (Ref. by 2012 LSC)	2013 Edition
Who may test & maintain EPSS	Overseen by a properly instructed individual	Overseen by a properly instructed individual	"Qualified Persons" as defined

3.3.9 Qualified Person. One who has skills and knowledge related to the operation, maintenance, repair, and testing of the EPSS equipment and installations and has received safety training to recognize and avoid the hazards involved."

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Major Changes in NFPA 110: 1999 to 2010

Category / Topic	1999 Edition (Ref. by 2000 LSC)	2010 Edition (Ref. by 2012 LSC)	2013 Edition
Monthly testing duration if using % loading criteria	30 minutes minimum under operating temperature conditions <u>or</u> at not less than 30 % of the EPS nameplate rating	30 minutes minimum under operating temperature conditions <u>and</u> at not less than 30 % of the EPS nameplate <u>kW</u> rating	SAME Adds Annex clarification on prime vs. standby ratings Permanent record of rating should be maintained and readily available.

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Major Changes in NFPA 110: 1999 to 2010

Category / Topic	1999 Edition (Ref. by 2000 LSC)	2010 Edition (Ref. by 2012 LSC)	2013 Edition
Monthly testing duration if using exhaust gas temp	30 minutes minimum	30 minutes minimum [Less in 2005 Ed. for <30% but reverted back to 30 min. minimum in 2010]	SAME
Spark ignited unit testing duration	Not mentioned (many assume to be same as DG)	30min or until water temp and oil pressure stabilize	SAME

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Major Changes in NFPA 110: 1999 to 2010

Category / Topic	1999 Edition (Ref. by 2000 LSC)	2010 Edition (Ref. by 2012 LSC)	2013 Edition
Annual load test criteria	2 hours: (25% 30min, 50% 30min, 75% 60min)	1.5 hours: (NLT 50% 30min, NLT 75% 60min) <i>[CMS Categorical Waiver]</i>	SAME

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Major Changes in NFPA 110: 1999 to 2010

Category / Topic	1999 Edition (Ref. by 2000 LSC)	2010 Edition (Ref. by 2012 LSC)	2013 Edition
EPSS (Gen to ATS) circuit breaker exercising	Annually with EPS (generator) off	SAME	SAME
EPSS (Gen to ATS) Medium Voltage circuit breaker exercising	Exercise @ 6 months + overload testing every 2 years	SAME	SAME

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Major Changes in NFPA 110: 1999 to 2010

Category / Topic	1999 Edition (Ref. by 2000 LSC)	2010 Edition (Ref. by 2012 LSC)	2013 Edition
3-year 4-hour load test	NONE (Started in 2005 edition)	4 continuous hours, transfer all ATS's, NLT 30% or exhaust gas temp; use just available load if spark	SAME
Combining tests	NONE	YES. Stipulates rules for combining annual & 3-year tests	SAME

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Major Changes in NFPA 110: 1999 to 2010

Category / Topic	1999 Edition (Ref. by 2000 LSC)	2010 Edition (Ref. by 2012 LSC)	2013 Edition
Optional standby systems	Not mentioned; many users, some AHJ's assumed them to be Level 2	Excluded when not Level 1 or Level 2	SAME

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Major Changes in NFPA 110: 1999 to 2010

Category / Topic	1999 Edition (Ref. by 2000 LSC)	2010 Edition (Ref. by 2012 LSC)	2013 Edition
Application	New installations unless a distinct hazard to life	SAME + Chapter 8 applies to new and existing systems	SAME

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Major Changes in NFPA 110: 1999 to 2010

Category / Topic	1999 Edition (Ref. by 2000 LSC)	2010 Edition (Ref. by 2012 LSC)	2013 Edition
Seismic Risk Areas	Minimum 96 hours without refueling if the need for EPS persists for this period of time	From 2005 Edition] ASCE 7 seismic design Category C, D, E or F require Class X = minimum 96 hours of fuel supply	Moved to Annex: ASCE 7 seismic design category C, D, E, or F should be minimum 96 hours without refueling if EPS operation is necessary for this period

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Major Changes in NFPA 110: 1999 to 2010

Category / Topic	1999 Edition (Ref. by 2000 LSC)	2010 Edition (Ref. by 2012 LSC)	2013 Edition
Engine Temperature	Min. 90F jacket water	As determined by manufacturer for cold start and load acceptance	Clarified, moved around, redundancies eliminated; no significant changes
Battery temperature	Min. 50F		
Engine room temperature	Min. 70F indoors; Min. 32F outdoors		

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Major Changes in NFPA 110: 1999 to 2010

Category / Topic	1999 Edition (Ref. by 2000 LSC)	2010 Edition (Ref. by 2012 LSC)	2013 Edition
Batteries	Nickel-cadmium or lead acid	Nickel-cadmium or lead acid; differentiates VRLA vs. vented (flooded)	SAME
Lightning protection system	Adequately protected	Use NFPA 780 where LPS is required	SAME
Distribution	Applicable reqmts; some details	Added NFPA 99 reference	SAME

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Major Changes in NFPA 110: 1999 to 2010

Category / Topic	1999 Edition (Ref. by 2000 LSC)	2010 Edition (Ref. by 2012 LSC)	2013 Edition
EPSS equipment in NP rooms containing electrical service equipment?	No	Level 1: Not where service >150 V-G and ≥1000 A	SAME
Other items in EPS rooms	No storage	Parts, tools, manuals for routine maintenance and repair are okay	SAME

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Major Changes in NFPA 110: 1999 to 2010

Category / Topic	1999 Edition (Ref. by 2000 LSC)	2010 Edition (Ref. by 2012 LSC)	2013 Edition
ATS transfer time in monthly tests	Not discussed	Not discussed	Class (10 sec) not required during monthly testing; if not met during monthly test, need process to annually confirm capability of system to comply

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ashe.org/annual

Major Changes in NFPA 110: 1999 to 2010

Category / Topic	1999 Edition (Ref. by 2000 LSC)	2010 Edition (Ref. by 2012 LSC)	2013 Edition
Provide portable when genset out of service	Give consideration	SAME	Give consideration when 10 sec cannot be met
Transfer switch listed for emergency service	Yes, where available	SAME	SAME, except MV CP or mechanical (not LS/CB or emergency loads) may be electrically interlocked MV breakers

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Major Changes in NFPA 11: 1999 to 2010

Category / Topic	1999 Edition (Ref. by 2000 LSC)	2010 Edition (Ref. by 2012 LSC)	2013 Edition
Protection from hazards	Rooms, shelters, or separate buildings located to minimize the possibility of damage from flooding (fire fighting, sewer, similar)	Rooms, shelters, or separate buildings <u>designed and</u> located to minimize the <u>damage</u> from flooding (fire fighting, sewer, similar)	Rooms, <u>enclosures</u> , or separate buildings designed and located to minimize the damage from flooding (fire fighting, sewer, <u>other</u>)

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Major Changes in NFPA 110: 1999 to 2010

Category / Topic	1999 Edition (Ref. by 2000 LSC)	2010 Edition (Ref. by 2012 LSC)	2013 Edition
Fuel quality testing, storage, other reliability issues	None. Annex notes discussed fuel storage and fuel shelf-life issues	Annually "using tests approved by ASTM standards" – language resulted in many questions	Annually "using appropriate ASTM standards." Standards are listed. 2013 edition has many new improvements & clarifications for reliability (tanks, piping, quality, storage, sampling, testing, maintenance) in Annex ¶ A.7.9.1.2. and ¶ A.8.3.8

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Tank sizing & storage life: NFPA 110-2013

7.9.1.3 Tanks shall be sized so that the fuel is consumed within the storage life, or provisions shall be made to remediate fuel that is stale or contaminated or to replace stale or contaminated fuel with clean fuel.

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Major 111 Changes for 2013

- Exclude Level 1 SEPSS from high energy normal power room
 - Note this does NOT apply to non-SEPSS UPSs
- Add DC Rectifier Plants to get ready for upcoming changes in telecom industry that will bring more DC systems into facilities



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Major Changes in NFPA 111: 1996 to 2010

Category / Topic	1996 Edition (Ref. by 2000 LSC)	2010 Edition (Ref. by 2012 LSC)	2013 Edition
SEPSS design and equipment	1990's era technology, now obsolete	Updated for modern technology, including fuel cells, flywheel systems, close-coupled hybrid rotary systems, ultracapacitor systems	Adds DC rectifier plants

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Major Changes in NFPA 111: 1996 to 2010

Category / Topic	1996 Edition (Ref. by 2000 LSC)	2010 Edition (Ref. by 2012 LSC)	2013 Edition
SEPSS equipment in NP rooms containing electrical service equipment?	Not discussed	Not discussed	Excludes Level 1 SEPSS from high energy normal power room (not bridging UPS's)

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Major Changes in NFPA 111: 1996 to 2010

Category / Topic	1996 Edition (Ref. by 2000 LSC)	2010 Edition (Ref. by 2012 LSC)	2013 Edition
Testing after repairs	Not discussed	After any repair or replacement, including battery replacement	SAME
Installation Acceptance Test	Time-sequenced, includes full load test	More detailed than previously, still includes full load test	SAME
First routine test	Immediately after acceptance test	SAME	SAME

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Major Changes in NFPA 111: 1996 to 2010

Category / Topic	1996 Edition (Ref. by 2000 LSC)	2010 Edition (Ref. by 2012 LSC)	2013 Edition
Types of records	Written records	Reproducible written records, also documentation of post-repair/replacement test	SAME
Stipulated SEPSS inspection	Inspect monthly with detailed PM requirements	SAME, added ohmic measurements	SAME

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Major Changes in NFPA 111: 1996 to 2010

Category / Topic	1996 Edition (Ref. by 2000 LSC)	2010 Edition (Ref. by 2012 LSC)	2013 Edition
Stipulated SEPSS maintenance	... maintained to ensure to a reasonable degree that the system is capable maintained so that the system is capable ...	SAME
Stipulated SEPSS exercising	Exercise quarterly lesser of at least 5 min or class. Annual: full load for full duration of Class	Expanded operational testing requirements Annual: full load for 60% of Class	SAME

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Major Changes in NFPA 111: 1996 to 2010

Category / Topic	1996 Edition (Ref. by 2000 LSC)	2010 Edition (Ref. by 2012 LSC)	2013 Edition
Stipulated battery maintenance	As part of quarterly inspection, includes load test	Load test details added, expanded to include ohmic measurements & response to bad readings	SAME

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Major Changes in NFPA 111: 1996 to 2010

Category / Topic	1996 Edition (Ref. by 2000 LSC)	2010 Edition (Ref. by 2012 LSC)	2013 Edition
Exclusions from NFPA 111 SEPSS requirements	<500 VA, <24v, <2 min, unit equip, nuclear, solar, wind, fuel cells	<500 VA, <24v, <2 min, unit equip, nuclear, solar, wind, UPS powered by an EPSS	SAME
Who may operate, test & maintain	Properly trained individual	Qualified personnel	SAME

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Major Changes in NFPA 111: 1996 to 2010

Category / Topic	1996 Edition (Ref. by 2000 LSC)	2010 Edition (Ref. by 2012 LSC)	2013 Edition
Remote annunciation	1990's era practices	Level 1 expanded to facility annunciation or network remote annunciation to reflect modern practices	SAME

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References

- NFPA 110-1999, NFPA 110-2010, and NFPA 110-2013 – Standard for Emergency and Standby Power Systems, NFPA; www.nfpa.org/110
- NFPA 111-1996, NFPA 111-2010, and NFPA 111-2013 – Standard for Stored Electrical Energy Emergency and Standby Power Systems, NFPA; www.nfpa.org/111
- ASHE White Paper: *NFPA 110 / 111 Changes for 2013*, originally presented at the 2012 ASHE Annual Conference: *contact speaker*
- NFPA 110-2013 Edition Addresses Generator Fuel Oil Management*, SSR Compliance News, September-October 2012 edition: *contact speaker*

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Emergency Power Standards for Health
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