NFPA 110 & 111 Update - Understanding the Evolution. Refer to NFPA Disclaimer.

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NFPA 110/111 Update – Understanding the Evolution

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• NFPA members can obtain staff interpretations of NFPA standards at www.nfpa.org.
Applicable Revisions

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Learning Objectives

- List the main requirements of **NFPA 110-2005** and **NFPA 111-2005**.
- Discuss differences between NFPA 110/111 and standards referenced by national accrediting organizations.
- Explain improvements from 2005 to 2010 editions.
- List proposals for the 2013 editions that relate to EPSS reliability improvements moving forward.
Some major changes in NFPA 110-2005 from previous (2002) edition

- Improved battery type definitions (3.3.2)
- Seismic requirements (5.1.2)
- Engine gauge & meter locations (5.6.3.4)
- Remote manual stop station (5.6.5.6)
- MV generators with unit transformers (5.6.9.4)
- ATS listing clarification (6.1.4)
- Level 1 EPSS not near high energy service equipment (7.2.2)
- Interior genset working clearance to 36” (7.2.5)

Some major changes in NFPA 110-2005 from previous (2002) edition

- Generator room storage (7.11.1)
- Outdoor generator lightning protection (7.11.4)
- Notify AHJ of installation acceptance test (7.13.3)
- Modified installation acceptance test (7.13)
- Modified monthly and annual testing (Ch.8)
- 3-year test only on Level 1 EPSS (8.4.9)
- Class X (hours of onsite fuel) clarified (A.4.2)
- Fuel testing & maintenance: new Annex material
7.2.2 Level 1 EPSS equipment shall not be installed in the same room with the normal service equipment, where the service equipment is rated over 150 volts to ground and equal to or greater than 1000 amps.

▶ Clarifies the clearance distance issues in equipment installations that may be installed in back to back configurations or along the same wall. Deleting 7.2.2.1 (which permitted ATS’s in normal power areas with twice the NEC clearance) removes the NEC Section 110.26 confusion and provides additional protection for higher voltage and high amperage services.

A.7.2.2 The intent of this requirement is to provide maximum fire protection to the most critical, high energy systems. Consideration should be given to the potential fire hazard when locating Level 2 EPSS equipment in the normal electrical service room, or to Level 1 systems below 1000 amperes and 150 volts to ground.

▶ Clarifies the clearance distance issues in equipment installations that may be installed in back to back configurations or along the same wall. Deleting 7.2.2.1 (which permitted ATS’s in normal power areas with twice the NEC clearance) removes the NEC Section 110.26 confusion and provides additional protection for higher voltage and high amperage services.
More Genset working clearance

[2005 Ed]

7.2.5 The EPS equipment shall be installed in a location that permits ready accessibility and a minimum of 0.9 m (36 in.) from the skid rails’ outermost point in the direction of access for inspection, repair, maintenance, cleaning, or replacement. This requirement shall not apply to units in outdoor housings.

► Changed clearance distance of 76 cm (30 in.) to .9 m (36 in.). The clearance distance is provided to ensure that maintenance and service can be provided on the equipment. The existing 30 in. barely provided adequate room to bend over or kneel down and work on the equipment. The change to 36 in. will provide adequate room for personnel to work on the equipment.

Generator room storage

[2005 Ed]

7.11.1 The room in which the EPS equipment is located shall not be used for other purposes that are not directly related to the EPS. Parts, tools and manuals for routine maintenance and repair shall be permitted to be stored in the EPS room.

► Comment - Allows storage of limited materials in generator rooms, and specifies what MAY be stored. This change was made to facilitate immediate repairs of failed components.
NFPA 110 Installation Acceptance Test (AHJ witnessed) [2005 Ed]

1. Simulate primary power failure (full normal power outage) with generator "cold start" and emergency load at standard operating level.
2. First 2-hour load test uses the actual EPSS building loads (no min. %).
3. First 2-hour load test with actual EPSS loads must use and test all paralleled generators that are intended to be operated simultaneously.
4. After first 2-hour test, NP is re-energized, transfer switches return to NP.
5. EPSS 5 minute cooldown, followed immediately by second 2-hour test
6. Second 2-hour full-load test (100% full rated load must be applied in one load step) using load bank with or without building loads. Paralleled generators may be tested individually but each generator is required to run at full load for 2 hours
7. Generator shut down, followed by tests of cycle cranking & safeties

36-month extended load test [2005 Ed]

- **NFPA 110 extended load test**
  - For duration of assigned Class*, for at least 4 hours
    - * NFPA 110 Class: The amount of time the EPSS is required to operate at its rated load without being refueled
  - Use EPSS loads running at the time
  - Open NP breakers-switches that feed transfer switches

- **TJC:**
  - Minimum 4 hours,
  - Requires only 30% nameplate loading
  - Dynamic or static load permitted
Some major changes in NFPA 111-2005 from previous (2001) edition

- Complete rewrite to comply with new NFPA Manual of Style
- Various rewrites to parallel similar content in NFPA 110
- Revised several definitions
- Improved battery type definitions (2.1.2)
- Revised ventilation requirements for consistency with NFPA 1 and NFPA 70

Common topics for FAQ’s on NFPA 110-2005

- Combining periodic tests
- 3-hour load test for how long
- When is EPSS Level 1 or Level 2
- Sequence of installation acceptance test
- What determines Class (X hours) and Type (10 sec) for each EPSS
- Details of required fuel oil quality testing
Common topics for FAQ’s on NFPA 110-2005

- Does NFPA 110 apply to an NEC Art 702 Optional Standby System?
- Why does 110 require 96 hour Class X in certain seismic risk areas?
- Why 30% tests w/ natural gas generators?
- Are the testing increments (% of rating for ___ minutes) exact values to be met?
- Must we exercise generators weekly?

Common topics for FAQ’s on NFPA 111-2005

- Do SEPSS testing requirements pertain to all of the hospital UPS’s, or just the important ones?
- Miscellaneous questions on testing and technology
Some major changes in NFPA 110-2010 from previous (2005) edition

- Excluded (Optional) Standby Systems that are not Level 1 or Level 2 [1.1.3(6)]
- Ch 8 applies to new and existing systems (1.3)
- Redefined Non-ATS to match UL 1008 (3.3.9.3)
- Deleted AHJ permission for Level 2 EPSS (4.4.2)
- Deleted low lube oil pre-alarm (Table 5.6.5.3, (e))
- Lightning protection per NFPA 780, no longer mandatory (7.11.4)
- Recommended diesel fuel [A.5.1.1(1)]

Some major changes in NFPA 110-2010 from previous (2005) edition

- Many major changes to installation acceptance test (7.13.4).
  - *In my opinion this was a big improvement.*
- Reversal of [2005] shortened monthly test for lightly loaded gensets

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Optional Standby Systems excluded from NFPA 110 scope [2010 Ed]

1.1.3 This standard does not cover the following:
(1) Application of the EPSS
(2) Emergency lighting unit equipment
(3) Distribution wiring
(4) Utility service, when such service is permitted as the EPSS
(5) Parameters for stored energy devices

(6) The equipment of systems that are not classed as Level 1 or Level 2 systems in accordance with Chapter 4 of this standard.

Substantiation: The scope of this document does not apply to the equipment of systems, such as optional standby systems covered by Article 702 of NFPA 70. This revision clarifies that point.

Chapter 8 Routine Maintenance and Operational Testing [2010 Ed]

• Clarified that Chapter 8 (Routine Maintenance and Operational Testing) applies to both new and existing systems
• No real change in intent but this keeps the code people happy

1.3 Application. This document applies to new installations of EPSSs, except that the requirements of Chapter 8 shall apply to new and existing systems.
Existing systems shall not be required to be modified to conform, except where the authority having jurisdiction determines that nonconformity presents a distinct hazard to life.

Substantiation: Chapter 8, Routine Maintenance and Operational Testing is written for existing systems and should be noted in the application statement or Chapter 8 could not be legally applied.
Recommended diesel fuel

Annex A.5.1.1(1), new 2nd sentence:

Diesel fuel should be either 1D, 2D, or a blend and have a minimum cetane rating of 40.

Substantiation: High speed diesel engines use either 1D or 2D fuels, important characteristics of diesel fuels are its viscosity, pour point, and cetane number. The primary differences between 1D and 2D fuel are the pour point and the viscosity. Pour point is the lowest temperature at which a liquid will flow. Viscosity is the resistance of a liquid to flow. A 1D fuel is designed for cold weather operation; thus, it is less viscous and has a lower pour point. A 2D fuel is used in warmer weather because it has a higher viscosity and pour point. The higher viscosity provides better lubrication qualities for the moving parts of the fuel injection system. The cetane number is a measure of the ease with which the fuel is ignited in the engine. It is most significant in relation to low temperature startability, warm-up and smooth, even combustion. Most engine manufacturers recommend diesel fuels with a cetane number of at least 40. Diesel fuels sold by reputable marketers meet or exceed this requirement.

Major changes to AHJ-witnessed 110 Installation Acceptance Test [2010 Ed]

• Reorganized for a more logical step-by-step sequence
• Addresses potential hazards of opening NP breakers and switches in occupied buildings.
• Eliminate unnecessary record keeping that is not critical to verification of proper operation.
• Duration of the first portion of the acceptance test is reduced because 1.5 hours sufficiently tests EPSS functionality with building load and reduces EPS emissions.
• Revisions to the second portion of the test to specify step test loading helps to mitigate potential EPS damage.
• Requiring certain documentation to be developed on site can require instrumentation that is not readily available at the EPS installation location.
• Requiring verification of engine start throughout the entire EPSS confirms this element of system starting.
• Annex material has been added on the term “cold start”
NFPA 110 & 111 Update - Understanding the Evolution. Refer to NFPA Disclaimer.

NFPA 110 Installation Acceptance Test

Major Changes [2010 Ed]

7.13.4.1.1* In a new and unoccupied building or facility, with the prime mover in a cold start condition and the emergency load at operating level, a normal power failure shall be initiated by opening all switches or circuit breakers supplying the normal power to the building or facility.

7.13.4.1.2* In an existing occupied building or facility, with the prime mover in a cold start condition and the emergency load at operating level, a normal power failure shall be simulated by operating at least one transfer switch test function or initiated by opening all switches or breakers supplying normal power to all automatic transfer switches that are part of the EPSS being commissioned by this initial acceptance test.

NFPA 110 Installation Acceptance Test

7.13.4.1.3 Major Changes [2010 Ed]

(1) When the EPSS consists of paralleled EPSs, the quantity of EPSs intended to be operated simultaneously shall be tested simultaneously with building load for the test period identified in 7.13.4.1.3(10).

(2) The test load shall be all loads that are served by the EPSS. There is no minimum loading requirement for this portion of the test.

(6)* The engine start function shall be confirmed by verifying operation of the initiating circuit of all transfer switches supplying EPSS loads.

(10) The load test with building load, or other loads that simulate the intended load as specified in Section 5.4, shall be continued for not less than 1.5 hours, and the run time is recorded.
NFPA 110 Installation Acceptance Test
Change to block loading [2010 Ed]

7.13.4.2 After completion of the test performed in 7.13.4.1, the prime mover shall be allowed to cool for not less than 5 minutes.

7.13.4.3* A load shall be applied for a 2-hour, full-load test. The building load shall be permitted to serve as part or all of the load, supplemented by a load bank of sufficient size to provide a load equal to 100 percent of the nameplate kW rating of the EPS, less applicable derating factors for site conditions.

7.13.4.3.1 This full-load test shall be initiated after the test specified in 7.13.4.1.3 by any method that starts the prime mover and, upon reaching rated rpm, picks up not less than 30 percent of the nameplate kW rating for the first 30 minutes, not less than 50 percent of the nameplate kW rating for the next 30 minutes and 100 percent of the nameplate kW rating for the next 60 minutes, on one step, less applicable derating factors for site conditions.

NFPA 110 Installation Acceptance Test
Other Changes [2010 Ed]

7.13.4.3.4 The data specified in 7.13.4.1.3(4), (5), (7), (8), and (9) shall be recorded at first load acceptance and every 15 minutes thereafter until the completion of the test period identified in 7.13.4.1.3(10).

7.13.4.4.3 The battery charge rate shall be recorded at 5-minute intervals for the first 15 minutes or until charge rate stabilization.

7.13.4.5 All safeties specified in 5.6.5 and 5.6.6 shall be tested on-site as recommended by the manufacturer.

**Exception. It shall be permitted for the manufacturer to test and document overcrank, high engine temperature, low lube oil pressure and overspeed safeties prior to shipment.**
Changes to 3-year / 4-hour load test

- Major rewrite to clarify requirements
- Allows use of ATS test switches
- 4 hours maximum (incorporates FI-05.1)
- Can combine 3 year test with 1 monthly load test and 1 annual load bank test. (settles ASHE/TJC FI request on 8.4.2.3 and 8.4.9.)
  - My recommendation: Be sure to meet worst case loading & duration criteria if you answer to AHJ's.
- Minimum loading as in monthly tests to mitigate wet-stacking and potential engine damage.

A.4.4.1 Level 1 systems discussion broadened to eliminate confusion

A.4.4.1 Typically, Level 1 systems are intended to automatically supply illumination or power, or both, to critical areas and equipment in the event of failure of the primary supply or in the event of danger to elements of a system intended to supply, distribute, and control power and illumination essential for safety to human life. Other NFPA codes and standards such as NFPA20, Standard for the Installation of Stationary Pumps for Fire Protection, NFPA 99, Standard for Health Care Facilities, and NFPA 101, Life Safety Code provide specific requirements on where Level 1 systems are required.

[DELETED PARAGRAPH: Level 1 systems usually supply emergency power for assembly occupancies greater than 1000 persons or in buildings above 23 m (75 ft) in height with any of the following occupancy classes: assembly, educational, detention, correctional, business, residential, and mercantile. Another occupancy typically served by Level 1 systems is health care where the combined load of the critical branch, life safety branch, and equipment system is greater than 150 kVA.]
Weekly EPS inspections [2010 Ed]

Add a new first sentence to annex A.8.4.1 to read:

A.8.4.1 **Weekly inspection does not require running of the EPS. Running unloaded generators as part of this weekly inspection can result in long term problems such as wet-Stacking.**

**Substantiation:** Running of unloaded generators as part of the weekly inspection can have deleterious effects including wet-stacking as well as environmental concerns.

My recommendation: be aware of AHJ requirements and manufacturer’s O&M recommendations – they may include weekly unloaded runs.

Major modifications to 111 [2010 Ed]

- Adds fuel cells; adds flywheel systems
- Excludes all unit equipment; not just emergency lighting
- Adds electrochemical devices such as ultracapacitors
- **Total rewrite of Chapter 5 (Emergency Power Supply: Energy Sources, Converters, Inverters, and Accessories) to reflect modern technology and practices**
- Differentiation between different types of batteries commonly used in SEPSS
- Changes in testing requirements
  - Annex now refers to IEEE 450, IEEE 1106, IEEE 1188
- UPS supplied by EPSS is not SEPSS, (not in 111)
NFPA 111 Level 1 inspection & testing requirements changed [2010 Ed]

8.4.1* Level 1 equipment shall be inspected monthly and tested in accordance with the manufacturer’s recommendations.

[DELETED: exercised at least quarterly under connected load for a minimum of 5 minutes or as specified for the class, whichever is less.]

(See next slide for new Annex language)
A.8.4.1 In addition to the manufacturer’s recommendations, the following standards provide information on battery inspection, testing, and maintenance.

2. IEEE 1106, Recommended Practice for Maintenance, Testing and Replacement of Nickel-Cadmium Storage Batteries for Generating Stations and Substations
3. IEEE 1188, Recommended Practice for Maintenance, Testing and Replacement of Valve-Regulated Lead-Acid Batteries for Stationary Applications

Depending on the type of batteries and the manufacturer’s recommendations the following should be included:

1. Monthly:
   - (a) Battery float voltage
   - (b) Pilot-cell float voltage and temperature

2. Quarterly: (a) Float voltage readings on all cells or multicell units, augmented in VRLA batteries by internal ohmic measurements on all cells or multicell units

3. Annually: (a) Discharge test under connected load for at least 5 minutes

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8.4.3.3 When a history of ohmic measurements is not used or maintained, the SEPSS shall be checked annually at full load for 60% of its class. A fully rated load bank shall be permitted in lieu of an actual load provided it is sized to be equal to the ECE rating.

8.4.4 The SEPSS shall be checked annually at full load for 60% of its class.

Substantiation: Testing for the full duration of the class results in battery degradation and a reduction in reliability.
NFPA 110 & 111 in 2012 update cycle
www.nfpa.org/110  www.nfpa.org/111

• Current status: Comments on ROP are in, ROC meeting in early October 2011
• NFPA 2012 Annual Meeting
• 2013 Edition

Technical Committee actions on 110 & 111 public proposals [2013 ROP]

• ACCEPT
• REJECT
• APR – Accept in Principle
• APP – Accept in Principle in Part

• Wording shown is as the TC modified it and then balloted.
Consideration should be given to sizing tanks in order to meet minimum fuel supplier delivery requirements, particularly for small tanks. Consideration should also be given to over sizing tanks, because many fuels have a shelf life and deteriorate with age. More importantly, biodiesel blends up to B5 (ASTM D975) have much shorter shelf lives than conventional diesel fuel (ULSD) and can accelerate degradation processes endangering the entire diesel fuel supply. Where large tanks are required fuel is stored for extended periods of time (such as exceeding 12 months), it is recommended that fuels be periodically pumped out and used in other services and replaced with fresh fuel. Prudent disaster management could require much larger on-site temporary or permanent fuel storage, and several moderate sized tanks can be preferable to a single very large tank.

Substantiation: … increase awareness of the reduced shelf life and accelerated deterioration issues involved with biodiesel blends up to B5 (ASTM D975).

In order to optimize the long term storage of fuels for prime movers, the fuel should be kept cool and dry, and the tank as full as possible. Tanks that are subject to temperature variations can experience accelerated fuel degradation especially if the tanks are outside and above ground or close to an extreme heat source if stored inside a structure. The more constant and cooler the tank temperatures the less likely temperature related fuel degradation will occur. Tank ullage (air space) should be kept to a minimum. Excess airspace allows for warm humid air to enter the tank and condense moisture during the cool evening. Also, prolonged exposure to ambient air which is 20 percent oxygen can facilitate oxidative degradation of the fuel.
Fuel Storage tanks should be kept as dry as possible and have with provisions for water drainage on a regular basis. The presence of water can lead to microbiological contamination and growth which in turn can lead to general or pitting corrosion of steel tanks and components possibly resulting in filter plugging, operational issues or a hydrocarbon release to the environment. Regularly scheduled surveillance of the fuel allows the operator(s) to evaluate the condition of the fuel and make important decisions regarding the quality of the fuel dedicated to reliable operation of the prime mover. Fuel maintenance and testing should begin the day of installation and first fill in order to establish a benchmark guideline for future comparison. Where possible, always seek laboratory testing services from a qualified or certified petroleum laboratory.

7.9.1.2 Fuel system design shall provide for a supply of clean fuel to prime mover by documentation of a fuel maintenance program that incorporates periodic centrifuge cleaning/polishing with high pressure tank agitation and or mechanical tank cleaning with auxiliary filtration, in addition to sampling by qualified personnel for laboratory analysis of diesel fuel.

7.9.1.3 Tanks shall be sized so that the fuel is consumed with in the storage life, or provisions shall be made to centrifuge clean/polish and laboratory test, or replace stale fuel with clean fuel.

A.7.9.1.2 Revision: Fuel maintenance filtration and water separators can remove contaminates and water returning fuel to conditions where it will provide reliability and efficiency for standby generators to protect prime movers' injection equipment when called upon in emergency conditions.

5.1.1(1) Liquid petroleum products at atmospheric pressure as specified in the appropriate ASTM standards and as recommended by the engine manufacturer.

5.1.1(2) Liquified petroleum gas (liquid or vapor withdrawal) as specified in the appropriate ASTM standards and as recommended by the engine manufacturer.

A.5.1.1(2) ASTM D1835 Standard Spec for LP Gases is a recognized standard covering LP gas.

A.5.1.1(3) ASTM does not have a standard specification for natural or synthetic gas. Industry generally uses pipeline specifications for natural gas quality.

Revise 8.3.8 to read:
A fuel quality test shall be performed at least annually using tests approved by appropriate ASTM standards.

Add a new annex Section A.8.3.8 to read:
A.8.3.8. Limited fuel quality testing performed annually using appropriate ASTM standard test methods is recommended as a means to determine that existing fuel inventories are suitable for continued long term storage. Special attention should be paid to sampling the bottom of the storage tank to verify that the stored fuel is as clean and dry as practicable, and that water, sediment or microbial growth on the tank bottom is minimized. ASTM D-975 contains test methods for existing diesel fuel.
**APR**

Log # 15

**Fuel oil quality & storage**

[2013 ROP]

A.5.1.1(1) See A.5.5.3 for shelf-life precautions for fuel supplies. Diesel fuel should be 1D, 2D, or a blend and have a minimum cetane rating of 40. **The grade of diesel fuel selected for use in a prime mover should be based on recommendations from the diesel engine manufacturer and ASTM D975 Standard Specification for Diesel Fuel Oils.** Where possible, the purchaser of fuel for the prime mover should specify a diesel fuel that does not contain biodiesel which can accelerate the degradation of the diesel fuel if stored for a period longer than six months. If diesel fuel is stored outside for long term storage, it may be necessary to use a winter or arctic grade of diesel fuel, or take extra precautions such as insulating and heat-tracing fuel tanks and lines to ensure that fuel will flow to the prime mover under the coldest possible conditions.

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**APP**

Log #3

**Fuel maintenance program**

[2013 ROP]

**Recommendation:**

7.9.1.2 Fuel system design shall provide for a supply of clean fuel to prime mover **by documentation of a fuel maintenance program that incorporates periodic centrifuge cleaning/polishing with high pressure tank agitation and or mechanical tank cleaning with auxiliary filtration, in addition to sampling by qualified personnel for laboratory analysis of diesel fuel.**

7.9.1.3 Tanks shall be sized so that the fuel is consumed with in the storage life, or provisions shall be made to centrifuge clean/polish and laboratory test, or replace stale fuel with clean fuel.

A.7.9.1.3 Fuel maintenance: Filtration and **water separators** can remove contaminate and water returning fuel to conditions where it will provide reliability and efficiency for standby generators to protect prime movers' injection equipment when called upon in emergency conditions.
Fuel maintenance program

Submitter's Substantiation: [Excerpts]
The number one failure to start emergency generators is bad batteries; a plugged fuel filter from contaminated fuel is the number one failure of diesel engines while running. Inadequate maintenance documentation is the number one cause of litigation loss.

Normal filtration is not a panacea. Filters and water separators are on generators to protect the injectors, rather than supply clean fuel. Specific guidelines to include new ideas, such as periodic fuel polishing of stored fuel, are needed for best fuel maintenance practices to ensure a clean fuel supply at all times for critical generators.

Many large fuel tanks for generators hold fuel that has been stored for years. Some use several types of additives that slow build up of certain contaminates, but do not address many of the elements for long term storage including elimination of existing contaminates, rust, water, and tank deterioration.

CONTINUATION OF Submitter's Substantiation: [Excerpts]
Fuel sampling alone is not a good indicator of clean fuel. It will not be accurate unless the tank walls are clean and free of fungus and slime build up. Fuel samples from the wrong locations without proper fuel agitation taken by untrained personnel will not show the true quality of fuel with a laboratory test.

Periodic generator testing does not require enough time for the hot fuel to circulate to break up microbiological algae from tank walls. Fuel filters and water strainers are a safety item to protect fuel injectors, not a solution for bad or contaminated fuel.

Topping off is part of fuel maintenance, but is consistently overlooked or ignored, due to the time and expense involved to add such a small quantity of fuel to refill the tanks. This causes condensation in fuel tanks, especially those stored in sunlight, i.e., adjacent to fire stations in high humidity areas such as coastal regions.

For only a few hundred dollars a year, fuel polishing by centrifuging and testing accurate samples taken by qualified personnel would eliminate the problem. Centrifuge polishing takes fuel to the ultimate state of cleanliness by removing all heavier particles such as wax, metals, water, microorganisms, dirt, etc., ensuring unplugged filters and reliability. Lab analysis after fuel polishing signifies a specific maintenance program and, with documentation, is very cheap litigation insurance.
Seismic 96 hour Class X
Log #CP14, #CP15

[DELETE] 5.1.2 Seismic design category C, D, E, or F, as determined in accordance with ASCE 7, shall require a Level 1 EPSS Class X (minimum of 96 hours of fuel supply).

Add new last sentence at end of Annex A.4.2:

Where the seismic design category is C, D, E, or F, as determined in accordance with ASCE 7, the EPS supplying a Level 1 EPSS should be capable of a minimum 96 hours operation without refueling if it is determined that EPS operation is necessary for this period.

TC Substantiations: Determination of the need for continued operation and the minimum operational time without refueling is a design consideration that is subject to approval of the AHJ and should not be a mandate in this standard. The standard does not provide this type of requirement for other natural disaster events. The information in this requirement is better suited as advisory and should be in Annex A.

The revised version of this former requirement reflects that 96 hours of operation is recommended where it is determined there is a need for continued operation of the EPSS in facilities such as hospitals or emergency management centers.

Maint./testing qualifications
Log #CP13

8.4.8 The routine maintenance and operational testing program shall be overseen by a properly instructed individual. EPSS components shall be maintained and tested by qualified person(s).

Add the following definition to Chapter 3:

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.

TC Substantiation: Reliable operation of the EPSS is highly dependent on the skill set of those performing maintenance and testing of the EPSS equipment. The revised text and new definition uses the NFPA 70 definition of qualified person as the basis for establishing a requirement and definition for those who perform the routine inspection, maintenance, and testing of EPSS equipment.
TJC 2010 Standard EC.02.05.07

DIR (Direct Impact Requirements) apply

The [organization] inspects, tests, and maintains emergency power systems.

Elements of Performance for EC.02.05.07

EP-1 D Test battery lights (req’d egress) for 30 sec every 30 days
EP-2 D Test battery lights (req’d for egress) for 90 min every 12 months or replace all batteries annually with 10% testing
A EP-4 D Operate generators for 30 minutes every 20-40 days / 3
A EP-5 Load tests above 30% or ≥ exhaust gas temp; annual 2-hr load bank tests if 30% or minimum temps are not satisfied / 3
A EP-6 D Operate all ATS’s every 20-40 days / 3
A EP-7 D 36-month 4-hour load test / 3
A EP-8 36-month load test above 30%, static or dynamic loads / 3
A EP-10 EP test failure requires retest after repairs / corrections

In a nutshell …

• WEEKLY inspections per manufacturer’s recommendations and NFPA 110-1999, paragraphs 6-3.6 and 6-4.1. Also refer to NFPA 110-2010, paragraphs 8.3.7 and 8.4.1 for more recent thinking.
• WEEKLY starts are NOT required by TJC, CMS, or NFPA. However you might have to do them if your state or local AHJ requires them (some do). If your engine manufacturer recommends weekly starts for Level 1 units (some do) then you would need to address that recommendation, perhaps with a risk assessment, when you set up your EC.02.05.01 EP-3 O&M program for those units.
• MONTHLY inspections and maintenance per manufacturer’s recommendations and NFPA 110-1999, sections 6-3 and 6-4. Also refer to NFPA 110-2010 paragraphs 8.3 and 8.4 for more recent thinking.
• MONTHLY (20-40 DAYS per TJC) load tests per EC.02.05.07 EP-4 and EP-5. The requirement is not less than 30 minutes at not less than the engine manufacturer’s recommended minimum exhaust gas temperature to avoid wet stacking. If you do not measure exhaust gas temperature, then you need to use the alternate requirement for not less than 30% of nameplate rating AT NOT LESS THAN 30 MINUTES AT OPERATING TEMPERATURE. Many hospitals get this wrong because they do not allow for engine warm-up time to get to operating temperature before they start taking their readings. Also, in my professional opinion one reading does not document 30 minutes. I recommend at least 3 sets of readings, one set at ~5 minutes (after warm-up), one set at 20 minutes, and one set at 35 minutes before you transfer back the ATS’s. This provides, again in my professional opinion, 30 minutes at operating temperature.
• MONTHLY (20-40 DAYS per TJC) documented operation of ALL ATS’s per EC.02.05.07 EP-6. You should list all ATS’s and require initials that they were in fact transferred on a specific date.
• QUARTERLY inspections and maintenance per manufacturer’s recommendations and NFPA 110-1999, section 6-3. Also refer to NFPA 110-2010 section 8.3 for more recent thinking.
In a nutshell … continued

- **ANNUAL LOAD TEST** only if required per EC.02.05.07 EP-5. The annual load test is only required if you do not satisfy the exhaust gas temperature requirement and also do not satisfy the minimum 30% loading requirement on any of the monthly tests. Satisfying either requirement for all 12 monthly tests eliminates the need for an annual load test for that year.
- **ANNUAL** inspections and maintenance per manufacturer’s recommendations and NFPA 110-1999, section 6-3. Also refer to NFPA 110-2010 section 8.3 for more recent thinking. Don’t overlook the ANNUAL fuel quality test per NFPA 110-2010, paragraph 8.3.8.
- **ANNUAL** operation of low voltage (< 600V) EPSS Level 1 circuit breakers per NFPA 110-1999, section 6-4.6. Also refer to NFPA 110-2010 section 8.4.7 for more recent thinking. This applies to most hospital EPSS systems. The EPSS is your generators and transfer switches and the equipment and wiring between them. The EPSS does not extend out to the LS, CB and EB branch panels, so this requirement does NOT involve operating CB, LS, EB branch panel breakers. [Note that medium voltage circuit breakers (rated in excess of 600 volts) for Level 1 system usage shall be exercised every 6 months and shall be tested under simulated overload conditions every 2 years.]
- **LESS FREQUENT** inspections and maintenance per manufacturer’s recommendations and NFPA 110-1999, section 6-3. Also refer to NFPA 110-2010 section 8.3 for more recent thinking.
- **AT LEAST EVERY 36 MONTHS**: 4-hour load test per EC.02.05.07 EP-7 and EP-8. Also refer to NFPA 110-2010 section 8.4.9. I recommend this edition rather than previous editions because we substantially improved the wording for this test in 2010.
- **Measures and retests** as required by EC.02.05.07 EP-9 and EP-10.
- **Installation Acceptance Test** on all new units and modifications per NFPA 110-2010, section 7.13. I recommend this edition rather than previous editions because we substantially improved the wording for this test in 2010.

Go to any NFPA code page
For example, for 110: www.nfpa.org/110
References

- NFPA Codes and Standards pages www.nfpa.org
- NFPA 110 ROP (Report on Proposals)
- NFPA 111 ROP (Report on Proposals)
- NFPA 110 page: www.nfpa.org/110
- NFPA 111 page: www.nfpa.org/111

Thank you. Questions anyone?

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(References follow this slide.)