

Data Center: How to Demonstrate Backup Power Readiness

Technical Bulletin

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Data Center backup power systems are essential to maximizing uptime and avoiding service outages that impact customer satisfaction and data center revenue. Ensuring readiness for outages requires regular testing to verify backup power availability and performance. NFPA 110 provides a basis for testing that can be used to confirm backup power readiness and retain the trust of users of data centers service.

An Overview of NFPA 110

[*The Uptime Institute reports that 36% of data center outages are power-related.*](#) To mitigate the risk of outages, the National Fire Protection Agency publishes [*NFPA 110 - Standard for Emergency and Standby Power Systems.*](#) It provides minimum guidance on the design, installation, maintenance, and testing of backup power systems, guidance that is referenced by other industry standards such as NFPA 70 – National Electrical Code. The test helps assure that the critical power system and its redundant sets operate as expected.

Key Provisions

NFPA 110 categorizes Emergency Power Supply Systems (EPSS), then prescribes requirements for installation, system maintenance, and periodic operational testing as follows.

EPSS Categories

NFPA identifies backup power systems by Class, Type, and Level.

Class

The code classifies EPSS into classes according to the amount of time that they must be able to provide power without refueling or recharging. Five time classes range from 5 minutes to 48 hours, and a sixth class allows the runtime to be defined by application, code, or the user.

Classification of EPSSs	
Class	Minimum Time
Class 0.083	0.083 Hr. (5 Min.)
Class 0.25	0.25 Hr. (15 Min.)
Class 2	2 Hrs.
Class 6	6 Hrs.
Class 48	48 Hrs.
Class X	As required by code, application, or user

Types of EPSSs	
Type	Minimum Time
Type U	Basically Uninterruptible (UPS)
Type 10	10 Seconds
Type 60	60 Seconds
Type 120	120 Seconds
Type M	Manual Stationary or Nonautomatic – No Time Limit



Type

NFPA 110 classifies EPSS by how quickly backup power must become available. The maximum amount of time that the load terminals of a transfer switch can be without power are defined by four types that range from “basically uninterruptible” to 120 seconds, plus a fifth type for manual switches, which has no time limit, as shown in the table above.

Level

NFPA Level 1 systems are required where a failure of backup power could result in loss of human life or serious injuries. Level 2 systems can be used where backup power is less critical to human life and safety.

Common Application

The Class, Type, and Level assigned to backup power systems vary by the missions of the facilities they serve. For data centers, the class and level may depend on the maximum time that any Uninterruptible Power Supply can keep the facility running as well as the nature of the operations or services supported by the facility.

Environmental Requirements

The standard requires facilities to protect EPSS from exposure to environmental conditions. For outdoor locations, an EPS must be installed in an enclosure that can resist rain and snow pursuant to local building codes and minimize damage from flooding. For indoor applications, Level 1 EPS equipment must be installed in a dedicated room that is constructed to a two-hour fire resistance rating.

NFPA 110 also addresses heating, ventilation, and air conditioning requirements for the EPSS spaces. Temperatures cannot exceed those specified by a system’s emergency power equipment manufacturers. Level 1 systems require heating to maintain ambient temperatures above 4.5°C (40°F).

Installation Testing

Once installed, EPSS must be tested to prove they can deliver backup power as required. The testing is completed without and with load for the durations shown in the following table.

Acceptance Test			
Test	Load Requirements	Duration	Reference
Initial Acceptance Test	EPSS loads, without minimum	1.5 Hours	NFPA 110 Article 7.13.4.1
Two-Hour Full-Load Test	30% of nameplate or more	First 30 Minutes	NFPA 110 Article 7.13.4.3
	50% of nameplate or more	Next 30 Minutes	
	100% of nameplate	Next 60 Minutes	



Maintenance Requirements

After an EPSS is installed, accepted, and placed in service, equipment maintenance and testing are necessary to demonstrate that backup systems can provide power when needed. NFPA 110 requires a written maintenance and testing program that complies with:

- manufacturers' recommendations
- instruction manuals
- minimum requirements of the Standard
- the requirements of the Authority Having Jurisdiction

The standard prescribes a scope of maintenance activities. For transfer switches and paralleling gear, the standard prescribes the following maintenance activities:

- Checking connections
- Inspecting or testing for overheating and corrosion
- Cleaning components
- Replacing contacts when required
- Verifying the proper function of controls for paralleling gear

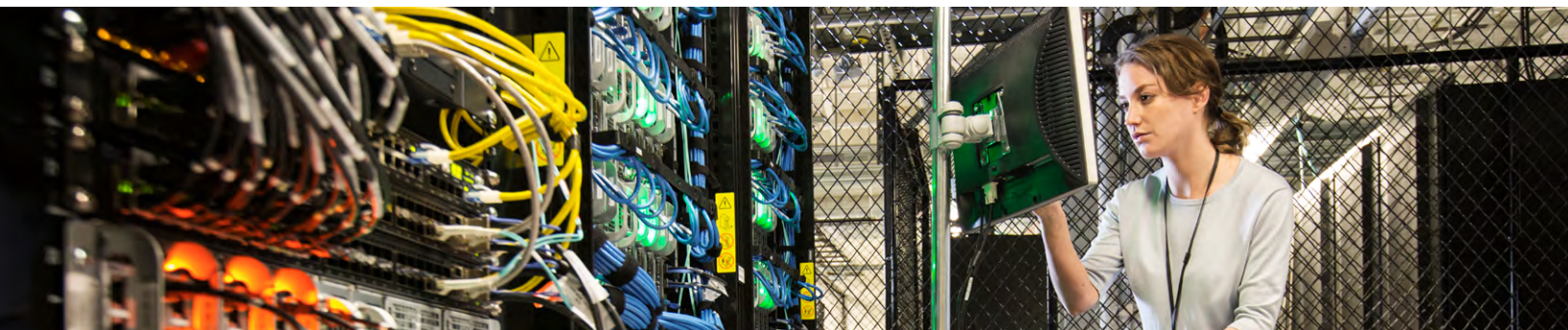
Additional Maintenance for Paralleling Gear:

- Maintenance and testing of batteries and fuel performed by qualified personnel
- Testing after equipment repair

Some specific requirements can be found in the standard. The following table summarizes periodic requirements.

Operational Tests for EPSSs			
Test	Load Requirements	Minimum Duration	Reference
Weekly Inspection	--	--	NFPA 110 Article 8.4.1
Monthly Load Test	Min. Exhaust Gas Temp OR ≥30% of rating	30 Minutes	NFPA 110 Article 8.4.
Diesel Sets Not Meeting Above Criteria - Annually	≥50% of rating	30 Minutes	NFPA 110 Article 8.4.2.3
	≥75% of rating	60 Minutes	
	100% of rating	90 Minutes	
For Level 1 EPSSs			
Triennial Test (1 per 36 months)	EPSS load for spark-ignited gensets	Class Runtime OR 4 Hrs. Max	NFPA 110 Article 8.4.2.3
	≥30% of rating for diesel gensets		

Notably, NFPA 110 Article 8.1.2 states, "Consideration shall be given to temporarily providing a portable or alternate source whenever the emergency generator is out of service..." and cannot meet the performance requirements for supplying power to loads. A quick connect panel and a permanent switching means can meet this requirement.



Streamlining NFPA 110 Compliance

Providing Adequate Load

To meet NFPA 110 test requirements, it is necessary to ensure that adequate load is applied to the backup power system and its generator(s). Quick Connect Panels offer a solution for adding a load bank whenever needed. Quick connect panels can also be used to bring in a temporary generator when a facility's permanent generator becomes unavailable. See [NEC Requirement for Permanent Manual Switching Means](#) for more information on this solution.

Recording and Reporting Power Tests

Proving that successful testing has been completed requires facilities to record the associated data and compile reports of the results. The larger the power system, the more complex this becomes. Recording power events and metrics for each generator, transfer switch, and other power devices can prove challenging and require significant labor. Automated compliance reporting applications can automate and streamline the collection and compilation. For additional information, see [Three Benefits of Automated Critical Power Reporting](#).

Conclusion

The maintenance and testing activities described in NFPA 110 form the basis for planning a backup power testing program. This includes both acceptance testing and periodic testing to verify that adequate backup power can be available whenever needed. Completing these tests is a key element in maintaining the trust of data center customers and end-users. Testing activities can be streamlined by providing connections for adding loads or even power sources, and by digitizing data collection and reporting tasks.

Any evaluation of a compliance strategy should be made only after reviewing NFPA 110 directly and consulting a qualified professional. For additional information about available solutions, contact an [ASCO Power Technologies representative](#).

For more information on NFPA 110:

National Fire Protection Agency
[NFPA 110 - Standard for Emergency and Standby Power Systems](#)

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