Generator & Transfer switch

Weekly inspections

To meet federal certification and state licensure requirements, healthcare facilities must inspect their emergency generators weekly [see NFPA 110(99), Sec. 6-4.1]. At a minimum, this weekly inspection should include a check of the following:

1. Fuel (check main and day tank fuel supply levels; day tank float switch; piping, hoses and connectors; operating fuel pressure; and for any obstructions to tank vents and overflow piping

2. Oil (check for proper oil level and oil operating pressure; lube oil heater)
• Engine oil level can be checked with the unit stopped or running on many engines; otherwise, it should be checked with the unit stopped
• Oil operating pressure should normally be above 40 psi

3. Cooling system (check coolant level, water pump(s), jacket water heater, belts, hoses, fan)

4. Exhaust system (check drain condensate trap and for possible leakage)

5. Battery system [look for possible corrosion; check specific gravity, electrolyte level (a level
between 1250 and 1275 is acceptable) and battery charger]

6. Electrical (conduct a general inspection of wiring and connections; check circuit breakers/fuses)

7. Prime Mover/Generator (Check for debris, foreign objects, loose or broken fittings; check guards and components; look for any unusual condition of vibration, leakage, noise, temperature or deterioration
NOTE: This is not an all-inclusive list. The equipment manufacturer may have additional maintenance requirements that will likely include monthly, quarterly, semi-annual and annual inspections and checks.

Monthly testing

1. To meet federal certification and state licensure requirements, healthcare facilities must exercise their emergency generators under load at least monthly [see NFPA 110(99), Sec. 6-4.1]. There are a number of ways to comply with this requirement:

a. The base requirement is that generators be exercised for a minimum of 30 minutes* using one of the following methods [see NFPA 110(99), Sec. 6-4.2]:

i. Under operating temperature conditions and at not less than 30 percent of the generator's nameplate kW rating. A 100 kW generator, for example, would need to be exercised under a load of at least 30 kW to meet this requirement.

• Normal operating temperatures are set by the manufacturer. Something to consider when scheduling your monthly tests is that your particular generator may not reach operating temperature in 30 minutes* and that running the generator for short periods of time may be harmful to the engine. You also want to make sure that the generator runs long enough to ensure that all engine parts are properly lubricated.

ii. Loading that maintains the minimum exhaust gas temperatures recommended by the manufacturer (it is unlikely that minimum exhaust gas temperatures will be reached if the generator isn't carrying a load equivalent to at least 30 percent of the generator's nameplate kW rating).
* *Note: Warm-up and cool-down times do not count toward the required 30 minutes.*

b. An alternate method is provided for diesel-powered generators that do not meet the testing requirements outlined in 1.a above. This could occur when, for example, a large generator in relation to the load is installed (e.g. either to account for the largest motor connected to the generator or to accommodate future expansion of the facility). Such generators can be exercised monthly with the available load and exercised annually with supplemental loads at 25 percent of nameplate rating for 30 minutes, followed by 50 percent of nameplate rating for 30 minutes, followed by 75 percent of nameplate rating for 60 minutes, for a total of 2 continuous hours [see NFPA 110(99), Sec. 6-4.2.2].

c. For gasoline-powered, natural gas-powered or propane-powered generators that do not meet the testing requirements outlined in 1.a above, it will likely be necessary to add more load to the generator or conduct a load bank test to comply with testing requirements (a load bank is, typically, a mobile piece of equipment that simulates the actual electrical load the generator is intended to power). Where equivalent loads are used for testing, it's important to note that such loads are required to be automatically replaced with the emergency loads in case of failure of the normal power [see NFPA 110(99), Sec. 6-4.2.1].

d. Where a generator set is used for peak load shaving or operated during a power outage, such use is allowed to be substituted for a routine monthly test, **provided** the generator is operated in accordance with the standards and the appropriate data are recorded. Another thing to keep in mind, however, is that NFPA 99(99), Sec. 3-4.4.1.1(b)1 requires a minimum 20-day and maximum 40-day interval between tests [see also NFPA 99(99), Sections 3-5.4.1.1(b) and 3-6.4.1.1(b)].

2. Load tests must include complete cold starts [see NFPA 99(99), Sec. 3-4.4.1.1(b)2; NFPA 110(99), Sec. 6-4.3].

3. Time delays must be set as follows [see NFPA 110(99), Sec. 6-4.4]:

a. Time delay on start: 1 second minimum.*
Exception: Gas turbine cycle: 0.5 second minimum.
*Note: NFPA 101(00), Sec. 7.9.1.2 requires that emergency loads be picked up within 10 seconds.

b. Time delay on transfer to emergency: none.

c. Time delay on restoration to normal power: 5 minutes minimum (to give the primary source sufficient time to stabilize before retransfer of the load, a delay of between 15 and 30 minutes is recommended).

d. Time delay on shutdown: 5 minutes minimum.

Transfer switches
1. Transfer switches are required to be operated monthly [NFPA 110(99), Sec. 6-4.5;].

2. This monthly test must consist of electrically operating the transfer switch from the normal/standard position to the alternate position and then a return to the normal/standard position [NFPA 110(99), Sec. 6-4.5].
• In many cases, a "Transfer Test" switch or button is provided and can be used to perform this test. Where this feature does not exist, it may be necessary to manually disconnect normal power in some fashion to the transfer switch (see "some words of caution on testing" below).

3. Transfer switches must also be inspected monthly to ensure that they are maintained free from accumulated dust and dirt and to check for deterioration of the transfer switch contacts [NFPA 110(99), Sec. 6-3.5].

4. Because they are such a key component in the successful operation of your emergency generator, it is recommended that you consider having infrared testing of your transfer switch(es) conducted annually to check for loose connections.

Some words of caution on testing…
1. Shutting off power, especially shutting off the main breaker, can expose a person to possible shock, electrocution and/or arc flash hazards. It is important; therefore, that anyone performing a test in this fashion be adequately trained and take proper safety precautions, including the wearing of proper personal protective equipment (PPE). *To reduce the safety risks, it is strongly recommended that facilities not already so equipped consider adding a switch for testing of their transfer switches*.

Generator Testing Requirements NFPA 99, 1999 Edition

3-4.4 Administration (Type 1 EES).

3-4.4.1 Maintenance and Testing of Essential Electrical System.

3-4.4.1.1 Maintenance and Testing of Alternate Power Source and Transfer Switches.

(a) Maintenance of Alternate Power Source. The generator set or other alternate power source and associated equipment, including all appurtenant parts, shall be so maintained as to be capable of supplying service within the shortest time practicable and within the 10-second interval specified in 3-4.1.1.8 and 3-4.3.1. Maintenance shall be performed in accordance with NFPA 110, Standard for Emergency and Standby Power Systems, Chapter 6.

(b) Inspection and Testing.

1. * Test Criteria. Generator sets shall be tested twelve (12) times a year with testing intervals between not less than 20 days or exceeding 40 days. Generator sets serving emergency and equipment systems shall be in accordance with NFPA 110, Standard for Emergency and Standby Power Systems, Chapter 6.

2. Test Conditions. The scheduled test under load conditions shall include a complete simulated cold start and appropriate automatic and manual transfer of all essential electrical system loads.

3. Test Personnel. The scheduled tests shall be conducted by competent personnel. The tests are needed to keep the machines ready to function and, in addition, serve to detect causes of malfunction and to train personnel in operating procedures.

3-4.4.1.2 Maintenance and Testing of Circuitry.

(a) * Circuit Breakers. Main and feeder circuit breakers shall be inspected annually and a program for periodically exercising the components shall be established according to manufacturer’s recommendations.

(b) Insulation Resistance. The resistance readings of main feeder insulation shall be taken prior to acceptance and whenever damage is suspected.

3-4.4.1.3 Maintenance of Batteries.

Storage batteries used in connection with essential electrical systems shall be inspected at intervals of not more than 7 days and shall be maintained in full compliance with manufacturer’s specifications. Defective batteries shall be repaired or replaced

immediately upon discovery of defects (see NFPA 70, National Electrical Code, Section 700-4).

3-4.4.2 Recordkeeping.

A written record of inspection, performance, exercising period, and repairs shall be regularly maintained and available for inspection by the authority having jurisdiction.

3-5 Essential Electrical System Requirements — Type 2.

3-5.1 Sources (Type 2 EES).

The requirements for sources for Type 2 essential electrical systems shall conform to those listed in 3-4.1.

Generator Testing Requirements NFPA 110, 1999 Edition

6-1 General.
6-1.1*
The routine maintenance and **operational testing program shall be based on the manufacturer's recommendations, instruction manuals, and the minimum requirements of this chapter** and the authority having jurisdiction.

6-4 Operational Inspection and Testing.
6-4.1*
Level 1 and Level 2 EPSSs, including all appurtenant components**, shall be inspected weekly and shall be exercised under load at least monthly.**
Exception: If the generator set is used for standby power or for peak load shaving, such use shall be recorded and shall be permitted to be substituted for scheduled operations and testing of the generator set, provided the appropriate data are recorded.

6-4.2*
Generator sets in Level 1 and Level 2 service **shall be exercised at least once monthly, for a minimum of 30 minutes, using one of the following methods:**

(a) Under operating temperature conditions or at not less than 30 percent of the EPS nameplate rating

(b) Loading that maintains the minimum exhaust gas temperatures as recommended by the manufacturer

The date and time of day for required testing shall be decided by the owner, based on facility operations.
6-4.2.1

Equivalent loads used for testing shall be automatically replaced with the emergency loads in case of failure of the primary source.

6-4.2.2

Diesel-powered EPS installations that do not meet the requirements of 6-4.2 shall be exercised monthly with the available EPSS load and exercised annually with supplemental loads at 25 percent of nameplate rating for 30 minutes, followed by 50 percent of nameplate rating for 30 minutes, followed by 75 percent of nameplate rating for 60 minutes, for a total of 2 continuous hours.

6-4.3

Load tests of generator sets shall include complete cold starts.

6-4.5

Level 1 and Level 2 transfer switches shall be operated monthly. The monthly test of a transfer switch shall consist of electrically operating the transfer switch from the standard position to the alternate position and then a return to the standard position.

Click the links below for the designated forms:

Emergency Generator – Weekly Inspection Checklist

Emergency Generator – Monthly Test Log