Generator Testing in Nursing Facilities

Introduction

Recent emergencies and natural disasters have emphasized the need to ensure that nursing facilities have an adequate EPSS in place should the loss of power occur.

Given the delicate manner in which health care services are provided in nursing facilities, facilities should have a frequently inspected (equipment off) and exercised (tested with the equipment on and running) on-site Level 1 EPSS with the capacity for enough fuel to run the Level 1 EPSS for at least seventy-two (72) hours should the facility experience a loss of power.

Exercises keep the machines ready to function and serve to detect malfunctions and train personnel in operating procedures. Adherence to proper and routine maintenance, inspection and operational testing reduces the risk of wet-stacking and improves equipment functioning.

Nursing facilities should keep a copy of NFPA 99 and NFPA 110 as referenced in the Virginia Uniform State Building Code (USBC) and the Virginia Statewide Fire Prevention Code (SFPC) on-site and should review them as needed. Of particular note, the NFPA 110 has sample maintenance schedules and maintenance logs as well as information on safe operation and testing procedures that may be of use to nursing facilities.

Nursing facilities are encouraged to have a policy in place that makes provisions for a portable generator or other alternate power source for situations in which the emergency generator malfunctions, or is out of service.

At least two (2) sets of instruction manuals for all major components of the EPSS should be supplied by the manufacturer(s) of the EPSS. Instruction manuals should be kept secured in a location convenient to maintenance/operations personnel and the equipment. At least two (2) people in the facility should know where the manuals are kept to increase the likelihood that the manuals can be readily accessible.

Evidence of the training received by the properly trained person should be kept in the designated employees' personnel file. In the absence of a properly trained person on-site, an outside vender may need to be contracted with to oversee the performance of all or part of the routine maintenance, inspection and operational testing. Records pertaining to the contracted vendor should also be kept by the facility.

As part of the comprehensive emergency preparedness activities, replacement parts identified by experience as high mortality items should be maintained in a secure location(s) on-site.

This guidance is in no way intended to replace NFPA standards. For more information for testing and maintenance of emergency generators please refer directly to NFPA 110.

Definitions

"Emergency Power Supply" or "EPS" means the source of the EPSS's electric power. The EPS should meet the required capacity and quality standards for the type and level of EPSS installed. The EPS includes all the related electrical and mechanical components of the proper size and/or capacity required for the generation of the required electrical power at the EPS output terminals. For rotary energy converters, components of an EPS include the following: prime mover, cooling system, generator, excitation system, starting system, control system, fuel system, and lube system, if required.

"Emergency Power Supply Systems" or "EPSS" means a complete functioning system of an EPS system coupled to a system of conductors, disconnecting means and overcurrent protective devices, transfer switches, and all control, supervisory, and support devices up to and including the load terminals of the transfer equipment needed for the system to operate as a safe and reliable source of electrical power.

“Level 1 EPSS” means an emergency power supply system that is installed when a potential failure of the equipment to perform could result in loss of human life or serious injuries. A Level 1 EPSS is expected to power essential electrical systems, including life safety illumination; fire detection and alarm systems; elevators; fire pumps; public safety communication systems; industrial processes where current interruption would produce serious life safety or health hazards; and essential ventilation and smoke removal systems. Licensed nursing facilities in Virginia are required to have a Level 1 EPSS installed.

"Level 2 EPSS" means an emergency power supply system that is installed when a potential failure of the equipment to perform is less critical to human life and safety and when a higher degree of flexibility than that provided by a Level 1 EPSS is permitted. A Level 2 EPSS is expected to power heating and refrigeration systems; communication systems; ventilation and smoke removal systems; sewage disposal; lighting; and industrial processes.

"On-site" means on the premises or campus of the nursing facility.

"Properly trained person" means a person with documented training and experience in the maintenance and operation of required emergency power systems.

"Wet stacking" or "cold stacking" means a condition that occurs when a generator's diesel engine operates below the rated output level or at only a small percentage of capacity and the engine over-fuels.

General Information

A. A Level 1 EPSS should be permanently installed in all licensed nursing facilities in Virginia as required by state building specifications.

B. The Level 1 EPSS should be located in a separate room dedicated to the generating equipment and should be provided with battery-powered emergency lighting.
    1. Battery-powered emergency lighting should be tested monthly for thirty (30) seconds and annually for ninety (90) minutes.

2. The room should be separate from the rest of the building by a minimum 2-hour fire rating or located in an adequate, leak-proof enclosure outside the building capable of resisting snow or rain at a maximum wind velocity required by local building codes.
3. The design of the heating, cooling, and ventilation system for the EPSS equipment room should address control or elimination of:
    a. Heat;
    b. Cold;
    c. Dust;
    d. Humidity;
    e. Snow and ice accumulations around housings;
    f. Louvers;
    g. Remote radiator fans; and
    h. Prevailing wind blowing against radiator fan discharge air.

General Inspection and Testing of the EPSS

C. The routine maintenance and operational testing program should be based on all of the following:
    1. Manufacturer's recommendations;
    2. Equipment instruction manuals;
    3. Minimum requirements of the NFPA 110; and
    4. The authority having jurisdiction.

Inspections

D. At least weekly, all ancillary components should be inspected. The weekly inspection should include, but is not limited to:
    1. A general inspection of the prime mover/engine/generator;
    2. Inspection of the fuel capacity and tank;
    3. A check of the quality and level lubrication oil;
    4. An inspection of the cooling system;
    5. An inspection of the exhaust;
    6. An inspection of the batteries;
    7. An inspection of the electrical system;
    8. An inspection and cleaning of the general conditions of the EPSS;
    9. An inspection and cleaning of the service room; and
    10. An inspection that the system is in automatic condition.

E. At least monthly, all ancillary components should be inspected. The monthly inspection should include the items identified in the weekly inspection and a specific inspection of:
    1. The fan belt;
    2. The Charge and rate;
    3. The Equalize charger;
    4. The Alternator belt;
    5. The Governor oil level and linkage; and
    6. The battery case, with a cleaning as needed.

Monthly Exercise

F. At least monthly, all ancillary components should be exercised under load as follows:
    1. Exercising the generators for a minimum of 30 minutes (not to include warm-up and cool-down times) using one (1) of the following methods:
        a. Loading that maintains the minimum exhaust gas temperatures recommended by the manufacturer;
        b. Under operating temperature conditions (as set by the manufacturer) and at not less than thirty (30) percent of the generator's nameplate kW rating; or
        c. If the engine cannot be loaded as required in F1b, the engine should be operated until the water temperature and the oil pressure have stabilized and then terminated before the 30 minute time period.

G. If the diesel EPS does not meet the requirements in F1, it can be exercised monthly with the available load. 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 by the facility).

H. For gasoline-powered, natural gas-powered or propane-powered generators that do not meet the testing requirements outlined in F1, it will likely be necessary to add more load to the generator or conduct a load bank test to comply with the testing requirements.[1] Where equivalent loads are used for testing, it is important to note that such loads must be automatically replaced with the emergency loads in case of failure of the normal power.

I. 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 according to the standards and appropriate data are recorded.

J. As part of the monthly test, the properly trained person should ensure that the EPSS picks up the load and meets the frequency and voltage requirements within ten (10) seconds of failure of the normal power system.

Triennial or Annual Exercise

K. At least every thirty-six (36) months, all ancillary components should be exercised under load as follows:
    1. Exercising the generators for a minimum of four (4) hours (not to include warm-up and cool-down times) using one (1) of the following methods:
        a. Loading that maintains the minimum exhaust gas temperatures recommended by the manufacturer;
        b. Under operating temperature conditions (as set by the manufacturer) and at not less than thirty (30) percent of the generator's nameplate kW rating; or

[1] A load bank is, typically, a mobile piece of equipment that simulates the actual electrical load the generator is intended to power.

c. If the engine cannot be loaded as required in F1b, the engine should be operated until the water temperature and the oil pressure have stabilized and then the test should be terminated before the 30 minute time period.

L. Diesel generators that do not meet the requirements in F1 can be exercised annually with supplemental loads at twenty-five (25) percent of name plate for thirty (30) minutes, followed by fifty (50) percent for thirty (30) minutes, followed by seventy-five (75) percent for sixty (60) minutes for a total of two (2) continuous hours.

M. As part of the test, the properly trained person should ensure that the EPSS picks up the load and meets the frequency and voltage requirements within ten (10) seconds of failure of the normal power system.

Circuit Breakers, Transfer Switches and Batteries

N. Circuit breakers, transfer switches and batteries should be inspected, tested and have a maintenance schedule.

O. Circuit breakers should be exercised annually with the EPS in "off position." Circuit breakers should be tested every two years under simulated overload conditions and circuit breakers rated in excess of 600 volts should be exercised every six months.

P. Transfer switches should be operated monthly and inspected quarterly to ensure that they are maintained free from accumulated dust and dirt and to check for deterioration of the transfer switch contacts.

Q. Maintenance of lead-acid batteries should include monthly testing and recording and a battery load test should be performed quarterly. Storage batteries should be inspected weekly.

R. Routine maintenance, inspection and operational testing of the circuit breakers, transfer switches and batteries should be overseen by a properly trained person.

S. Special tools and testing devices necessary for routine maintenance should be available for use when needed.

Fuel Storage

T. All licensed nursing facilities should have dedicated fuel storage capacity on-site to power the Level 1 EPSS for a minimum of seventy-two (72) hours.

U. The nursing facility should contract with a reputable fuel delivery company to ensure the facility has the needed fuel supply delivery during all emergency situations.

Records

V. The facility should create and maintain on-site a written schedule for routine maintenance, inspection and operational testing of the EPSS and all ancillary equipment.

W. The facility should keep records on-site of all inspections and tests. The written records should be available for inspection by the fire code official.

X. All records of the EPSS inspections, tests, exercising, operation, and repairs should be maintained for at least three (3) years and should be open for review by the state fire marshal, building inspectors, and inspectors from VDH.

References

National Fire Protection Association. NFPA 110: Standard for Emergency and Standby Power Systems.

Minnesota Department of Public Safety, Division of the State Fire Marshal, Health Care Inspection and Emergency
Preparedness materials. Retrieved from: https://dps.mn.gov/divisions/sfm/programs-services/Pages/health-care-inspection.aspx.