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Testing for Emergency Lighting and the Advantages of Self-Diagnostic Systems

Installing emergency lighting is just the first step in providing building occupants a safe path of egress during power outages. Equally important is following up with regular, required testing and maintenance. Unfortunately, many facility managers are failing this crucial task. Research from Hochiki, a European manufacturer of life safety systems, showed that more than half of surveyed businesses are risking the safety of building occupants by failing to monitor and maintain emergency lighting systems. Random samples in the US provided similar results. Owners are violating life safety codes, risking fines from the authorities having jurisdiction (AHJs), and exposing themselves to liability for injuries or tragic loss of life in a power outage, fire, or other emergency.

All emergency lighting codes – even those that don't specify specific light levels, placement, or testing regimens – require adequate and reliable illumination for paths of egress and exits. Reliability is key, in that emergency lighting and exit signs must not fail when the power fails or smoke fills the air. Routine testing and maintenance are crucial to ensuring that egress lighting is operating effectively and will help save lives when the need arises.

Periodic testing of emergency lighting systems, and documentation of that testing, can be incredibly demanding in terms of time for maintenance personnel and disruption of business operations. But new, self-diagnostic products greatly simplify the process. A self-diagnostic emergency lighting product runs the prescribed tests on its own components and alerts maintenance personnel when a unit is likely to fail in a outage, fire, or other emergency.

Emergency lighting liability issues

The heartbreaking Grenfell Tower fire in London (2017), in which 72 lives were lost, occurred in a building that reportedly had a history of dilapidated emergency lighting in stairwells, as well as allegations that "contractors who were responsible for inspecting the emergency lighting system had been falsifying their inspection certificates for several years and giving the system a clean bill of health." When emergency lighting fails in a blackout, occupants may become confused or trapped if they fail to egress quickly. The risk of injury from trips and falls increases and, particularly in a dark stairway, panic can cause additional injuries and delays in evacuation, even unnecessary deaths.

Emergency evacuation should be part of a company's overall emergency planning and periodic risk assessments. Evacuation plans and drills ensure that all personnel know the shortest path to an emergency exit and the assembly area where all personnel can be accounted for. Assuring the dependability of lighting systems goes beyond maintaining the equipment. Paths of egress must be checked, particularly after renovations or changes in the use of a space, to make sure they will be illuminated properly and allow a quick escape. Neglected maintenance and documentation of both escape routes and emergency egress lighting can result in fines, even prison.

In the US, fines from the Occupational Safety and Health Administration (OSHA) are $12,675 per violation, with willful or repeated violations at $126,749 per violation. OSHA assesses safety violations on a company-wide basis, so a "repeated violation" could concern different sites; that is, two or more locations within the past 5 years. These figures pale in comparison to defending or settling a possible wrongful injury or death lawsuit. In some jurisdictions, even first responders are permitted to sue for injury or wrongful death.

What are the testing requirements?

Code requirements for emergency lighting and the maintenance and testing of emergency lighting equipment vary from jurisdiction to jurisdiction. Outside the US, codes will vary widely. For instance, Australia's fire code requires a 90 minute test every 6 months, and European standard EN 50172 requires a daily visual check of all system indicators. US codes generally recognize the National Fire Protection Association's National Electrical Code (NFPA 70) and Life Safety Code (NFPA 101).

The OSHA Code of Federal Regulations requires adequate illumination that "must be in proper working order at all times" and defers to NFPA 101. OSHA also recognizes an alternative path to compliance, the International Code Council's International Fire Code, which conforms with the International Building Code. The IFC cites very specific illumination levels and uniformity ratios for emergency lighting, and the areas that must be addressed. It also requires assurance that emergency and exit lighting systems will provide illumination for at least 90 minutes

NFPA 70 requires specific installation and performance characteristics for emergency and exit lighting systems and, along with UL 924, provides functional standards for battery-powered emergency and exit lighting. Emergency lighting units must illuminate in the case of an outage, but the functional lighting of the space must be available to be used and controlled normally. This includes popular emergency lighting ballasts and fixtures that also serve as functional lighting.

NFPA 101 outlines emergency lighting design requirements and strategies, along with functional testing. These testing requirements constitute the single greatest failure point for owners.

Basic testing requirements from NFPA 101 chapter 7

- Monthly: 30 seconds of emergency illumination
- Annual: 90 minutes of emergency illumination

Testing strategies

Regular performance of periodic testing – and, of course, timely follow-through when maintenance issues arise – can avert the danger of occupants trying to navigate a space in darkness or using flashlights and cellphones to find stairs and evacuation routes. A power outage is frightening in itself, but a fire or other emergency combined with a blackout can induce panic and cause unnecessary injuries and deaths.

Two basic testing regimens are required by NFPA 101 Chapter 7:

1. A monthly activation test requiring that emergency lighting come on and provide the required illumination for a minimum of 30 seconds.

2. An annual test where lights are activated for 90 minutes to simulate a long-term emergency.

In addition, written records of these monthly and annual tests – and documentation of timely follow-through with maintenance and re-testing when problems arise – must be maintained for inspection by OSHA or any other AHJ. Note that local AHJs may have different requirements for testing or require that records be maintained for a specific length of time. Note also that an AHJ may require that the person overseeing the testing have specific or general training for the task.

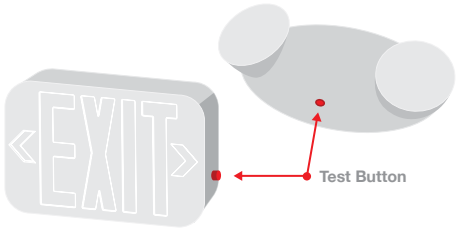
The traditional, manual method of performing the monthly functional test requires that maintenance personnel push and hold, for the full 30 seconds, a test button on the emergency lighting unit to simulate a short outage. The light source should light up (or remain illuminated, sometimes at a dimmer level), while operating on the battery. The full 30 seconds is required to ensure that the battery has more than just a residual charge, which may illuminate the unit for only a few seconds and then go dim or fail completely. After the test, the unit should immediately return to normal power mode.

Depending on the size of the building, it can take an average maintenance staff a full day every month to button-test emergency lighting fixtures – perhaps more where a scissor lift or bucket truck is required. Emergency lighting units that are particularly difficult to access can be equipped to receive test signals from a remote control, which can save significant labor.

Alternatively, if general lighting is locally controlled, maintenance personnel may locate the circuit breaker (if breakers are properly labeled) that will cut power to the space, simulating an outage. Personnel then perform a walkthrough, carefully noting that all emergency lighting fixtures are illuminating properly.

This method may also cut power to other systems, such as computers or mission

The Button Testing Method:
Maintenance personnel must press and hold button for 30 seconds



- Labor-intensive
- May require ladder or lift
- Disruptive to normal building operations

critical equipment, so care should be used to ensure that other battery backups are in place and functional, or that data is saved. Depending on the business operations or power needs of a space, this option may be impractical.

Most often, these walkthrough inspections in an "induced" power outage need to be performed after hours, perhaps incurring overtime charges.

This method can test a large number of devices, or highly inaccessible devices, efficiently. Adjustable emergency fixtures should be checked to see if they have become misaligned. Units using LED arrays can be checked for spot failures of individual LEDs and for overall lumen depreciation.

For the annual test, button testing is unwieldy. Rather than testing for 90 minutes annually, some facilities will go ahead and replace all the batteries throughout the emergency lighting system. This is not a substitute for testing, as the battery is not always the point of failure. In addition, a newly installed battery must then charge and maintain that charge, perhaps over a few days, and then be tested for 30 seconds anyway. The only other option is to open each unit and physically interrupt power for the duration of the inspection. The extended, annual inspection may be staggered throughout the year for different areas of the facility, provided careful logs and schedules are kept.

Overall, manual testing of emergency lighting systems, along with keeping records and documenting maintenance measures, is highly difficult and almost impossible in large facilities.

Easier: self-testing and self-diagnostics

This onerous manual testing of emergency lighting can be significantly eased with "smarter" emergency lighting units. These products work on the principle that where testing, maintenance, and documentation regimens are easier, compliance – and ultimately safety – will improve.

These units test themselves and "report" any problems with batteries, chargers, and light sources. Depending on the product, an indicator light or lights (LEDs) will illuminate or flash in a specific pattern to signal the specific problem. Self-diagnostics will indicate a problem with a battery, driver, or LED array, or indicate charging or discharging (in a test or emergency) mode.

Maintenance personnel need not conduct the manual test or simulate a power failure monthly. They merely walk through and check the indicator lights; documenting the status of each unit. Where visual inspection of a self-testing, self-diagnostic unit is performed at 30-day intervals, the functional test is not required.

But an equally important advantage of this walkthrough is that personnel regularly

ensure that paths of egress are clear and exit signs are clearly illuminated and have not been obstructed by renovations or changes in the use of the space.

The walkthrough may be performed during normal business hours (no overtime); and specific notes are taken to call out any anomaly in each unit's status indicator light. The technician can then focus on the repair. They already know where the problem is, before going up the ladder. Procedures and documentation must still include a quick manual test after maintenance and charging. An emergency lighting system with self-testing and self-diagnostics may cut inspection and maintenance hours to a third of that required for manual testing.

Units test themselves at random or heuristically programmed times, which can be distracting for occupants. But the advantage is that an occupant may report an outage or change in a status indicator quickly. Many problems are identified and addressed before the next walkthrough, inspection by an AHJ, or emergency.

Self-testing, self-diagnostic emergency lighting units will self-perform the extended, annual tests, as well. Again, where visual inspections are performed and documented at 30-day intervals, the onerous 90 minute functional test is not required.

Expensive, centralized testing and monitoring system may be appropriate for very large, networked systems or in multisite applications requiring remote access from anywhere in the world. They provide detailed status reports and notifications that focus on equipment and can be useful where an owner contracts out for maintenance. (But be aware that contracting out for emergency lighting system testing and maintenance may not remove liability from the owner.) After an emergency or in a spot inspection by OSHA or another AHJ, these computer-based emergency lighting systems must be capable of generating testing reports at all times.

These large centralized systems focus on equipment faults, which does not account for changes in facility design or usage. Walkthroughs looking for visibility of exit signs and clear paths of egress are still required. This is a primary human element of building life safety.

The self-testing advantage

Has your emergency lighting system been installed and then forgotten? Will your facility undergo an inspection by OSHA or another AHJ this year? Will your valued employees face a fire, explosion, or natural disaster?

Building owners and business managers are all concerned with the safety of occupants and exposure to liability, regardless of codes and AHJs. Self-testing, self-diagnostic emergency lighting units consistently run the prescribed tests

Examples of Self-Diagnostic Indicator Codes

Solid Green: System OK

Flashing Green: Self-Diagnostic check ongoing

Slow Flashing Red: Battery not connected

Flashing Red: Battery pack failure

* From Fulham HotSpot LED Constant Power emergency driver FHSCP-UNV-10P-L-SD

on their own components and then indicate when a unit is likely to fail. Thus, documenting testing compliance and timely spot maintenance are both much easier and cost-efficient. But most important, in a blackout or other emergency, occupants can find their way out – safely.

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