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International Code Council revises International Building Code to require Glow-in-the-dark path markings in stair wells in new and existing high rise buildings

Summary of new IFC regulation and guidelines to implement life saving photoluminescent emergency evacuation systems

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NEW INTERNATIONAL FIRE CODE SECTION 1027 ADOPTED

On September 16, 2008 signifying a shift toward enhanced high rise building evacuation in the post 9/11 environment the International Code Council revised the International Fire Code to include New York City's standards requiring the installation of glow-in-the-dark path markings in the stairwells of new and existing high rise buildings over 75 feet tall. The code will go into effect January 1, 2009.

Designed to glow in the dark when emergency generators and lighting fails, photoluminescent path markings enable people inside buildings to safely use enclosed staircases in the event of an emergency evacuation. Under the new requirements, photoluminescent strips will be placed on steps, handrails, and the perimeter of enclosed stairwells in new high-rise buildings built in municipalities across the country that use the International Building Code. When emergency lighting fails, the strips will help building occupants navigate their way out of the building in a quick and safe manner.

“As more cities move to build high-rise commercial towers, it is important to standardize the system of symbols and signage that help people find their way out in the event of an emergency. **A calm, organized evacuation can save lives.** With more buildings across the country using photoluminescent materials, building occupants will be **better protected from trips and falls commonly found to occur in dark stairwells** during emergency evacuations. My team and I are pleased that the lessons New York City learned after 9/11 are resonating. “said Patricia Lancaster, FAIA in June, 07 in Real Estate Weekly.

FAILURE OF EMERGENCY BACKUP SYSTEMS AND EFFECTIVENESS OF NEW PHOTOLUMINESCENT TECHNOLOGY LEADS TO IFC SECTION 1027

Two events led to New York City and ultimately The International Building code requiring the inclusion of glow-in-the-dark path markings in stairwells of high rise buildings. First, according to the **National Institute of Standards and Technology's final report on the 9/11 disaster, World Trade Center evacuees said that photoluminescent markings guided them out of the towers quickly.** The markings were installed in the towers after the 1993 bombings.

The second influencing event was the **August 2003 black out**, which left a good portion of the Northeast without electrical power. In New York, **the emergency electrical backup systems in many buildings failed**, typically due to poor maintenance, faulty batteries and generators, or improper installation. **Without this emergency power, people were stranded in buildings, unable or scared to make their way down the exit stairs.**

**FAILURE OF ELECTRICAL EMERGENCY BACKUP SYSTEMS
DRAMATICALLY INCREASE THE POTENTIAL FOR INJURY OR DEATH IN
AN EMERGENCY**

73% of deaths in fires are caused by smoke inhalation. According to Security Management Magazine there are 50,000 business fires causing over \$1.5 billion in property damage and hundreds of deaths and injuries annually. Not to mention the consequences of power outages and other natural disasters.

Currently most local codes generally require overhead battery or electrically powered exit signs to be visible within 100 feet under normal conditions. In addition some industries and localities require backup emergency electrical lighting.

But think about this for a moment...

*A flaming fire causes smoke to rise quickly, obscuring point sources of light such as overhead exit signs and emergency lighting. Also as evidenced by the 2003 blackout in the Northeast and cited above by the ICC it is well documented that generators, battery and electrically powered lighting, often fail during an emergency causing total darkness. In smoky dark conditions **the burden is on the occupant to spot discrete exit signs which can be up to 100 feet away!** In fact exit signs are the last piece of information an occupant needs during emergency evacuation- without a continuous stream of egress guidance **occupants may never reach the exit sign.***

The failure of battery and electrically powered signage is a factor in many high fatality fires not to mention electrical power outages. **Studies quoted in The Industrial Fire Journal show that only 8% of evacuees in real fire catastrophes noted the presence of electrical point sources of light.** They could not see the electrical exit signs. **Even when emergency backup lighting does work rising smoke obscures the exit sign.**

In summary the combination of the lessons learned from 9/11, the 2003 Northeast blackout and the ineffectiveness of electrical, battery and generator backup systems even when they do work are the reasons behind the ICC's adoption of the requirement for glow-in-the-dark path markings in stairwells.

You have probably not experienced one of these emergencies, and hopefully you never do, but it is likely that in the past few years you have been challenged to question your approach to building security and how to safely evacuate occupants in the event of an emergency?

**THE CRITICAL QUESTION IS: HOW QUICKLY CAN YOU EVACUATE
LARGE NUMBERS OF OCCUPANTS IF YOU HAVE AN EMERGENCY?**

**THE ESSENTIAL ELEMENTS OF ICC COMPLIANT GLOW-IN-THE-DARK
EMERGENCY STAIRWELL EVACUATION SYSTEMS**

ICC compliant systems provide continuous low level guidance to quickly lead large numbers of occupants out of any darkened or smoke filled stairwell. The system must not require mechanical, electrical or human intervention to work when needed. The following attributes are present in the most effective code compliant systems. **Understanding the elements below will assist you in interpreting IFC 1027 and make it easy to translate the code to your building.**

A complete safety grade product line

Glow-in-the-dark photoluminescent products are made from Strontium Aluminate Oxide. The development of Strontium Aluminate Oxide in 1995 was the catalyst for a remarkable leap forward for the deployment of effective emergency evacuation systems. This newly recognized earth-born Photoluminescent pigment is a 10 fold improvement in glow intensity and duration over Zinc Sulfide. It is also a non toxic, non radioactive, natural product. Strontium Aluminate Oxide pigment stores UV light energy under lightened conditions and discharges that energy with a glow under dark conditions. Just 60 to 90 minutes of ambient light exposure will charge the Strontium Aluminate to give off a glow for 6-10 hours in darkness. The length and intensity of the glow is determined by the amount of pigment in the product. It does not denigrate over time. The life cycle is indefinite.

Continuous placement along the steps and evacuation route

Continuous placement along the stairwell egress route keeps occupants in touch with the evacuation route at all times, until they reach safety. The power of Strontium Aluminate Oxide products combined with the ability to easily place them in a manner in which occupants never lose site of the evacuation route, are critical elements of an effective system which can evacuate large numbers of occupants quickly. **Constant visual contact with the evacuation route is the life raft that keeps fleeing occupants in control when they are evacuating a smoke filled or darkened building.**

Low level placement along the evacuation route

Your system must be continuous and low to the floor. If the area is dark and is also smoke filled, the system should be close enough so that evacuating occupants can always see the glow from it. If the smoke is extremely thick and you are overcome by it, your natural reaction will be to drop to your knees, in which case you will see the photoluminescent glowing and you will be able to crawl towards the exit and out of the smoke. **The importance to the psychology of a fleeing occupant, of this short viewing distance, and constant contact with the evacuation route can not be over stated- especially in the tight confines of darkened stairwells.**

Photoluminescent Anti Slip stair nosings

Stair nosings with anti slip and photoluminescent strips serve as the built in core of the system. These nosings provide the **benefits of both low level visual egress and slip prevention.** Slips and falls are the second largest cause of accidental injuries in the United States. When quickly evacuating a large number of people from a tight stairwell; slips and falls are known to be a major hazard and cause of injury. While tape, paint and guidance treads will meet the new code they don't provide anti slip protection. Also high traffic stairwells subject tape, paint and guidance treads to abuse and more frequent replacement. **Stair nosings with profiled grooves, anti slip and photoluminescent inserts provide a more complete and durable solution.**

Spatial guidance on steps, handrails, floor landings and wall and exit enclosures

Imagine walking down an unfamiliar unmarked stairwell in total darkness or smoke. **Photo luminescent anti slip stair nosings give fleeing occupants both visual and spatial guidance** to allow them to swiftly and safely descend the stairs. Combine this with photoluminescent markings on handrails, floor landings and the perimeters of wall and exit enclosures and occupants are guided safely to the exit. This advance guidance system prevents many injuries due to tripping and falling and also provides fleeing occupants with an added feeling of confidence and control.

Low level exit signs and door handle markers

High level electrical exit signs often fail or are obscured by smoke. Low level Photo luminescent exit signs near the bottom of doors are always visible so if the electrical exit sign fails or can't be seen, **the low level Photoluminescent exit sign will always be visible and will guide fleeing occupants out of the exit to safety.** Photoluminescent **door handle markers** clearly identify the exit door handle in total darkness **assisting fleeing occupants through the exit door.**

Obstacle identification

IFC section 1027 requires that the evacuation route is equipped with discreet photoluminescent signage or marking tape for identifying obstructions such as standpipes, hose cabinets, wall projections and restricted height areas. In smoke and darkness firemen and other emergency officials are able to find their way and the tools they need to control the emergency in a speedy and safe manner. Guidance for firemen and other officials often saves lives. **Photoluminescent egress systems not only assist fleeing occupants but they also assist firemen and other first responders entering the building.**

INTERNATIONAL FIRE CODE
SECTION 1027-EXIT PATH MARKINGS
(May 2007 Version)

1027.1 General. Approved luminous markings delineating the exit path shall be provided in exit enclosures, including vertical exit enclosures, including vertical exit enclosures and exit passageways, of buildings Group A, B, E, I, M, and R-1 having occupied floors located more than 75 feet (22 860mm) above lowest level of fire department vehicle access and shall comply with Sections 1027.1.1 through 1027.1.7

Exception: Exit path markings shall not be required in lobbies or areas of open parking garages, where such lobby or area is located on the level of exit discharge and complies with the exception to Section 1023.1.

- **1027.2.1 Steps.** A stripe shall be applied to the horizontal leading edge of each step and extend for the full length of the step. Outlining stripes shall have a minimum horizontal width of 1 inch (25 mm) and a maximum width of 2 inches (51 mm). The leading edge of the stripe shall be placed at a maximum of ½ inch (13 mm) from the leading edge of the step and the stripe shall not overlap the leading edge of the step by not more than ½ inch (13 mm) down the vertical face of the step.

1027.2.2 Landings: The leading edge of the landings shall be marked with a stripe consistent with the dimensional requirements for steps.

1027.2.3 Handrails: All handrails and handrail extensions shall be marked with a stripe having a minimum width of 1 inch (25 mm). The stripe shall be placed on the top surface of the handrail for the entire length of the handrail, including extensions and newel post caps. Where handrails or handrail extensions bend or turn corners, the stripe shall not have a gap of more than 4 inches (102 mm).

1027.2.4 Perimeter demarcation lines: Stair landings and other floor areas within exit enclosures, with the exception of the sides of steps, shall be provided with demarcation lines on the floor or on the walls or a combination of both. The stripes shall be 1 (25 mm) to 2 inches (51 mm) wide with interruptions not exceeding 4 inches (102 mm).

1027.2.4.1 Floor mounted demarcation lines: Perimeter demarcation lines shall be placed within 4 inches of the wall and shall extend to within 2 inches (51 mm) of the markings on the leading edge of landings. The demarcation lines shall continue across the floor in front of all doors.

Exception: Demarcation lines shall not extend in front of exit doors that lead out of an exit enclosure and through which occupants must travel to complete the exit path.

1027.2.4.2 Wall mounted demarcation lines: Perimeter demarcation lines shall be placed on the wall with the bottom edge of the stripe no more than 4 inches (102 mm)

above the finished floor. At the top or bottom of the stairs, demarcation lines shall drop vertically to the floor within 2 inches (51 mm) of the step or landing edge. Demarcation lines on walls shall transition vertically to the floor and then extend across the floor where a line on the floor is the only practical method of outlining the path. Where the wall line is broken by a door, demarcation lines on walls shall continue across the face of the door or transition to the floor and extend across the floor in front of such doors.

Exception: Demarcation lines shall not extend in front of exit doors that lead out of an exit enclosure and through which occupants must travel to complete the exit path.

1027.2.4.3 Transition: Where a wall mounted demarcation line transitions to a floor mounted demarcation line, or vice-versa, the wall mounted demarcation line shall drop vertically to the floor to meet a complimentary extension of the floor mounted demarcation line, thus forming a continuous marking.

1027.2.5 Obstacles: Obstacles at or below 6 feet 6 inches (1981 mm) in height and projecting more than 4 inches (102mm) into the egress path shall be outlined with markings no less than 1 inch (25 mm) in width comprised of a pattern of alternating equal bands of luminescent luminous material and black, with the alternating bands no more than 2 inch thick and angled at 45 degrees. Obstacles shall include, but are not limited to, standpipes, hose cabinets, wall projections, and restricted height areas. However, such markings shall not conceal any required information or indicators including but not limited to instructions to occupants for the use of standpipes.

1027.2.6 Doors from exit enclosures: Doors through which occupants within an exit enclosure must pass in order to complete the exit path shall be provided with markings complying with sections 1027.6.1 through 1027.2.6.3

1027.2.6.1 Emergency Exit Symbol: The door shall be identified by a low-location luminous emergency exit symbol complying with NFPA 170. The exit symbol shall be a minimum of 4 inches (102 mm) in height and shall be mounted on the door, centered horizontally, with the top of the symbol no higher than 18 inches (457 mm) above the finished floor.

1027.2.6.2 Door Hardware markings: Door hardware shall be marked with no less than 16 inches² (406 mm²) of luminous material. This marking shall be located behind, immediately adjacent to, or on the door handle and/or escutcheon. Where a panic bar is installed, such material shall be no less than 1 inch (25 mm) wide for the entire length of the actuating bar or touchpad.

1027.2.6.3 Door frame markings: The top and sides of the door frame shall be marked with a solid and continuous 1 inch to 2 inches (25 mm to 51 mm) wide stripe. Where the door molding does not provide sufficient flat surface on which to locate the stripe, the stripe shall be permitted to be located on the wall surrounding the frame.

1027.3 Uniformity: Placement and dimensions of markings shall be consistent and uniform throughout the same exit enclosure.

1027.4 Materials: Luminescent exit path markings shall be permitted to be made of any material, including paint, provided that an electrical charge is not required to maintain the required luminance. Such materials shall include, but not limited to, self-luminous materials and photoluminescent materials. Materials shall comply with either:

1. UL 1994, or
2. ASTM E 2072, except that the charging source shall be 1 foot candles (11 lux) of fluorescent illumination for 60 minutes, and the minimum luminance shall be 30 milicandelas per square meter at 10 minutes and 5 milicandelas per square meter after 90 minutes.

1027.5 Illumination: Exit enclosures where photoluminescent exit path markings are installed shall be provided with the minimum means of egress illumination required by Section 1006 for at least 60 minutes prior to periods when the building is occupied.

1027.22 Exit path markings. Existing buildings of Group A, B, E, I, M and R-1 having occupied floors located more than 75 feet (22,860 mm) above the lowest level of fire department vehicle access shall be provided with exit path markings in accordance with Section 1027.

Exception: Open, unenclosed stairwells in historic buildings designated as historic under a state or local historic preservation program.

NOTE: Section numbers may be revised in the final publication

The IBC has established 10 occupancy groups, with some having multiple subgroups. These subgroups are numbered with a purpose. The lower the number, the greater the perceived risk is for the occupants. For example, A-1 has large occupant loads in fixed seating. Whereas A-5 is includes seating of large numbers of people for viewing outdoor activities. Assuming the occupancies had equal occupant loads, the A-1 is indoors with fixed seats

that reduce egress speed. The A-5 occupancy, although having fixed seats, is outdoors reducing the risk of smoke and heat build up within the seating area. The 10 occupancy groups and their respective subgroups are listed below:

- Assembly: Groups A-1, A-2, A-3, A-4 and A-5
- Business: Group B
- Educational: Group E
- Factory and Industrial: Groups F-1 and F-2
- High Hazard: Groups H-1, H-2, H-3, H-4 and H-5
- Institutional: Groups I-1, I-2, I-3 and I-4
- Mercantile: Group M
- Residential: Groups R-1, R-2, R-3 and R-4
- Storage: Groups S-1 and S-2
- Utility and Miscellaneous: Group U

Residential (Group R) occupancies apply to buildings that are used for sleeping purposes, among the many other uses associated with residential uses. R-1 and R-2 groups apply to buildings that house occupants in large numbers. R-1 includes transient type housing consisting of hotels and motels, while R-2 housing is more of a permanent nature, such as apartments and dormitories. Groups R-3 and R-4 are required to comply with the requirements of the *International Residential Code (IRC)*. R-3 occupancies include single detached houses and duplexes and R-4 occupancies include assisted living and residential care facilities that have more than 5, but less than 16, occupants, including staff.