NCDOI OSFM Evaluation Services

Scope of DOI White Paper: The Purpose of this document is to provide clarification on North Carolina State Code requirements to Code Officials (CEO) who are agents for the Authority Having Jurisdiction (AHJ).

DOI File Number: WP-004-10
Edition Date: June 17, 2010

Subject of White Paper: Photoluminescent Exit Signs

Contents

1.0 Intent and Definitions ................................................................. 1
2.0 North Carolina Code Requirements for Photoluminescent Exit Signs ........................................ 2
3.0 UL 924 Standards for Photoluminescent Exit Signs ........................................................................ 2
4.0 Permanent Markings on a Photoluminescent Exit Sign ................................................................... 3
5.0 Review Considerations Prior to Issuing Permit ................................................................................. 4
6.0 Field Installation and Inspection ................................................................................................... 5
7.0 References ................................................................................................................................. 6

1.0 Intent and Definitions

A. This document addresses the following:

1. Replacement of any existing non-photoluminescent exit sign with a new photoluminescent exit sign, or the
2. Replacement of any existing photoluminescent exit sign with a new photoluminescent exit sign, or the


C. Definition of “photoluminescent” from Section 1002 of the NCBC and Section 1002 of the NCFPC is as follows: “Having the property of emitting light that continues for a length of time after excitation by visible or invisible light has been removed”.

D. From Wikipedia, “photoluminescence” is defined as “the process in which a substance absorbs protons and then re-radiates photons”. In simple terms, when the material that has absorbed protons from an external light source is placed in a dark room, the re-emitting protons produce a glowing light effect that can be visible to the human eye for a given time.
2.0 North Carolina Code Requirements for Photoluminescent Exit Signs

A. Section 1011 of the NCBC and Section 1011 of the NCFPC address the code requirements for exit signs, including photoluminescent exit signs. Section 1011.4 (Internally Illuminated Exit Signs) states that photoluminescent exit signs “shall be listed and labeled in accordance with UL 924 and shall be installed in accordance with the manufacturer’s instructions and Chapter 27. Exit signs shall be illuminated at all times*”.

*The external charging light must be on at all times to keep the photoluminescent exit sign fully charged, even when the building is not normally occupied. As stated in the 2009 International Building Code Commentary, “Exit signs must be illuminated at all times, including when a building may not be fully occupied. If a fire occurs late at night, there may be cleaning crews or persons working overtime in the building who will need to be able to find the exits”.


3.0 UL 924 Standards for Photoluminescent Exit Signs - The following is a synopsis of the testing procedures and standards in Supplement SG of UL 924. (Recommendation is for the CEO to refer to UL 924 [2006] when reviewing a photoluminescent exit sign submittal for code compliance.):

A. Only a photoluminescent exit sign that is listed and labeled permanently with the trademark of a North Carolina accredited Third Party Testing Agency on the sign face or frame showing that it has successfully met the minimum requirements of UL 924 can serve as a compliant “exit sign” under the UL 924 standards and consequently also be compliant with the NCBC and the NCFPC.

B. Only a fully assembled photoluminescent exit sign, ready for field installation, can be evaluated for compliance with UL 924. With the exception of adhesively secured directional indicators (i.e. arrows, chevrons etc.), all other decals, pigments, markings, etc. shall be applied by the manufacturer and should not be applied or modified in the field by others without prior written approval by the sign manufacturer.

C. Section 40 (entitled “Exit Sign Visibility”) of UL 924 includes the requirements for photoluminescent exit sign graphics, which are equivalent to the requirements addressed in Section 1011.5.1 of the NCBC and of the NCFPC.

D. If the listed viewing distance of a photoluminescent exit sign evaluated under UL 924 is less than 100 feet, the face of the photoluminescent exit sign shall be permanently marked with the legible viewing distance, i.e., 50 feet, 75 feet, etc.

E. Except in the event of primary power loss to the external light source, the face of a photoluminescent exit sign shall be illuminated at all times in accordance with Section 1011.4 of the NCBC and of the NCFPC by a reliable external charging light source. External light source requirements for charging a photoluminescent exit sign are as follows:

1. The sign manufacturer designates the type of external light source and the minimum luminance level (most often 5 foot-candles or 54 lux) needed to fully charge the word “EXIT” and any required directional indicator(s) on the face of the photoluminescent exit sign. UL 924 requires this information to be permanently marked on the sign. (Note that
types of external light sources can include incandescent, fluorescent, metal halide, mercury vapor, and high-pressure sodium, etc.)

2. Using the type of external light source at the stated luminance level indicated on the sign, the UL test measures the length of time it takes to fully charge the graphics, based on the amount of time prescribed by the photoluminescent exit sign manufacturer. (Note- the time required by most manufacturers to fully charge a sign is usually 60 minutes.)

3. After the photoluminescent exit sign is fully charged in the time required by the sign manufacturer, the external light source is removed and the luminance level is measured in total darkness at 1 minute and again at 90 minutes. The intent is for a photoluminescent exit sign to maintain its listed viewing distance at 90 minutes after the exterior charging light source has been removed.

4. The external charging light source is not required to be on an emergency back-up power source.

F. Supplement SG1.2 of UL 924 states that “photoluminescent signs evaluated in accordance with this Supplement (SG) are for indoor dry or damp location where not exposed to direct unfiltered sunlight, liquids, or temperatures outside the range of 10-40 degrees C (50-104 degrees F)”. To be suitable for outdoor wet locations, signs shall be tested for ultraviolet light exposure conditions under UL 746C (2004 Standard) entitled “Standard for Polymeric Materials-Use Equipment Evaluations”. Photoluminescent exit signs complying with UL 746C can be marked accordingly by the manufacturer. (Note - If the sign is to be use at an outdoor location but is not marked according, do not recommend approval without verification from a North Carolina accredited Third Party Testing Agency that it has been tested and is suitable for this condition.)

4.0 Permanent Markings on a Photoluminescent Exit Sign

A. As addressed in Supplement SG5 (Markings and Installation Instructions) of UL 924, the requirements for all permanent markings on a photoluminescent exit sign shall be “visible after installation, i.e., on the sign face or exposed frame member. The letters shall be a minimum 1/16 inch high. The markings are paint-stenciled, die-stamped, indelible lettering or a label system suitable for the surface that complies with the Standard for Marking and Labeling, UL 969. All lettering shall be of a color that contrasts with the background.”

B. The following information is to be permanently marked and visible on the sign face or frame of the photoluminescent exit sign to indicate compliance with UL 924:

1. The listing mark of a North Carolina accredited Third Party Testing Agency shall include their trademark symbol , the word “LISTED”, the word “PHOTOLUMINESCENT EXIT SIGN”, and a control number.

2. If the labeled visible distance of the sign is less than 100 feet, the sign shall be permanently marked with a written statement indicating the maximum rated “LEGIBLE VIEWING DISTANCE ______”. The blank shall specify the distance in feet.

3. The photoluminescent exit sign shall be permanently marked to indicate the type of external light source and the minimum foot-candle (or lux) required from the light source to shine on the sign face for providing continuous charging. Example of a statement that may be permanently marked on the sign for various types of external charging light sources and the minimum foot-candle (or lux) required are as follows:
a. For incandescent lamp type: “MINIMUM 5 FOOT-CANDLE (or 54 LUX if applicable) EXTERNAL LIGHT MUST BE PRESENT ON THE SIGN FACE AT ALL TIMES”.

b. For fluorescent lamp types: “MINIMUM 5 FOOT-CANDLE (or 54 LUX if applicable) EXTERNAL LIGHT UNFILTERED FLUORESCENT ILLUMINATION MUST BE PRESENT ON THE SIGN FACE AT ALL TIMES”.

c. For other lamp types: “MINIMUM 5 FOOT-CANDLE (or 54 LUX if applicable) EXTERNAL _______LIGHT MUST BE PRESENT ON THE SIGN FACE AT ALL TIMES”. In accordance with SG5.4 of UL 924, “the blank shall specify the manufacturer, catalog number, and type of lighting source used for testing”.

4. The sign can be marked accordingly if approved for outdoor wet locations by a North Carolina accredited Third Party Testing Agency.

5.0 Review Considerations Prior to Issuing Permit - To properly review and evaluate a photoluminescent exit sign submittal, it is recommended that a CEO request the applicant to provide the following information in writing, along with any other needed documentation, to substantiate that the minimum level of safety continues to be maintained, as required by the Codes:

A. A copy of the UL 924 test results from the product manufacturer for the proposed photoluminescent exit sign, including test recommendations. Information should indicate the type of external light source at a stated luminance level, the listed viewing distance after there has been a loss of power to the external charging light source for a minimum of 90 minutes and the length of time required to recharge the sign face.

B. A copy of the printed installation instructions from the manufacturer, including any special requirements or limitations.

C. A copy of any guarantee/warranty issued by the sign manufacturer.

D. A plan of each floor with the following information:

   1. The location of all photoluminescent exit signs, the location of the external charging lights, dimensional spacing/distance between exit signs and directional arrows (if applicable) proposed in the project.

   2. If the proposed work is being performed in an existing building, indicate the location of any existing photoluminescent or non-photoluminescent exit signs (and directional arrows if applicable) that are not being replaced with new photoluminescent exit signs in the project.

   3. The location and a description of the type of control (breaker, un-switched control, etc.) providing power for the external charging light sources should be indicated.

      a. The power for the external charging light should be supplied on a circuit not controlled by automatic timers or sensors.

      b. The control(s) should be accessible only to authorized personnel for assurance that the external charging lights are on at all times.

E. If feasible, request an actual sample of the proposed photoluminescent exit sign. The purpose is to confirm compliance with the permanent markings required by UL 924, as addressed in this document under Section 4.0. (After approval, the CEO can return the sample to the applicant for incorporation into the project.)
F. If a replacement date is not permanently marked on the sign face, recommend the sign manufacturer provide written confirmation that the type of photoluminescent material used to maintain continuous illumination does not decline over time and consequently reduce the legible viewing distance. (Note—a copy of this information should be kept on site to be available for maintenance and for fire inspections.)

G. Submittal should have written confirmation by the manufacturer that the proposed signs are safe to handle and install, unlike, for example, self-powered tritium-containing exit signs, which are radioactive and require special handling.

H. The submittal should include a written confirmation by the manufacturer that the products were manufactured under an approved quality control program with inspections by an inspection agency accredited by one of the accreditation bodies listed on the American National Standards Institute (ANSI) website at the following link:

http://www.standardsportal.org/usa_en/conformity_assessment/3party_conformity_assessment.aspx#Accreditation

6.0 Field Installation and Inspection

A. Confirm that the photoluminescent exit sign has been installed in accordance with the manufacturer’s printed instructions for the condition of the project and is permanently secured.

1. Section SG2.1 of UL 924 states that “A photoluminescent exit sign shall be provided with rigid structure or mounting so that the sign remains flat when mounted as intended”.

2. SG2.3 of UL 924 requires that the sign be fastened securely to the mounting surface and further states, “Adhesive shall not be provided as the sole means for mounting”. If acceptable to the sign manufacturer, recommend using security type screws for anchorage that require a special screwdriver bit for removal, even with ability to be installed with a normal screwdriver. Anchorage is of particular importance if the signs are being installed in a school, dormitory or other locations occupied primarily by young people.

B. Confirm the external charging light source and the minimum level of luminance on the face of the sign from the external charging light source on the face of the sign meets, or exceeds, the minimum level of light under which the sign was tested for compliance with UL 924-2006. One accurate way to confirm the luminance level on the sign face is a light meter.

C. Confirm the installation complies with the listed legible viewing distance. Suggest viewing each sign at the listed maximum distance with and without any lights (in total darkness after switching off all surrounding convenience lights and the external charging light).

D. Verify that the power for the external charging lights is supplied on a circuit that is not controlled by automatic timers or sensor. Only authorized personnel should have access to the control(s).

E. Require a copy of the manufacturer’s printed information and other documentation including any guarantee/warranty be permanently kept on site in a secure location to be available for maintenance and for fire inspections. SG5.5 of UL 924 states the following: “All photoluminescent exit signs shall be provided with installation instructions that include the following two statements verbatim:

“CAUTION: EXTERNAL ILLUMINATION SOURCE REQUIRED”
And

"SAVE THESE INSTRUCTIONS FOR FIRE SAFETY INSPECTIONS"

Additionally, the instructions shall include the following information in any convenient format:

1. Identification of the minimum required external illumination charging source in accordance with the testing conducted under SG4.2.1.2;

2. Instructions to select or install an external illumination source that is deemed reliable and is supplied by a circuit not controlled by automatic timers or sensors that turn off the charging light, and whose controls are accessible only to authorized personnel;

3. Instructions that the external illumination source is to be energized at all times;

4. Instructions that lighting levels on the sign are to be reassessed after any changes in external lighting types or levels to determine that the sign is still being illuminated in accordance with its Listing;

5. Instructions to periodically clean the sign face with a damp cloth or as otherwise recommended by the manufacturer;

6. Instructions to conduct periodic visibility tests in accordance with the applicable installation code (i.e., NCBC or NCFPC); and

7. If applicable, instructions to install the sign indoors only, where not exposed to direct unfiltered sunlight, liquid spray, or temperatures outside the range of 10-40 degrees C (50-104 degrees F).

7.0 References

A. 2012 North Carolina Building Code (NCBC)
B. 2012 North Carolina Fire Prevention Code (NCFPC)
F. NFPA 101 (2006 Standard Reference Number)
G. Wikipedia

This document does not constitute an evaluation of any vendor’s product nor does this document imply that the Code Enforcement Official must approve any specific material, design, or method.