NATIONAL LIGHTING PRODUCT INFORMATION PROGRAM

Specifier Reports

Exit Signs

Energy-efficient, internally illuminated exit signs and retrofit kits

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Contents

Introduction

The lighting that is required for emergency egress from buildings has two components: the lighting of the escape routes to the exits, and the marking of those routes and the exits themselves with exit signs. This issue of *Specifier Reports* is concerned only with the latter.

Many existing exit signs use incandescent lamps. Although the electrical power demand of each sign is small, approximately 24 to 40 watts, each sign typically is operated 24 hours a day, 365 days a year; so, each sign consumes 210 to 350 kilowatt-hours of electricity per year.

By using light source technologies that are more energy efficient than conventional incandescent lamps, the power demand and energy consumption of exit signs can be reduced markedly. Many new exit signs are available that use alternative light source technologies. Retrofit kits are also available for converting existing incandescent-type signs to more energy-efficient light sources. This issue of *Specifier Reports* covers both kinds of products: energy-efficient, internally illuminated exit signs (herein referred to as "exit signs") and energy-efficient retrofit kits (herein referred to as "retrofit kits") for existing internally illuminated exit signs. This report includes manufacturers' product information for 57 products and the results of the National Lighting Product Information Program's (NLPIP) evaluations of the products' photometric properties, power characteristics, readability, and visibility in smoke.

The production of this report involved important contributions from many staff members at the Lighting Research Center (LRC). C. DeCusatis carried out the photometric measurements; K. Sasiadek conducted the power measurements; L. Canon, N. Babapulle, and R. Strobel measured the readability of the exit signs; and A. Bierman, C. DeCusatis, and J. Raffucci collaborated on the Smoke-Sim software. Other LRC project team members who contributed include J. Ceterski, J. Fan, E. Gillmeister, M. Guilfoyle, D. Larkin, and R. Wolsey.

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Background

Light Source Technologies

Five different light source technologies commonly are used in internally illuminated exit signs. They are: incandescent lamps, fluorescent lamps, light-emitting diodes, electroluminescent panels, and radioluminescent tubes (see Figure 1).

Incandescent lamps. Incandescent lamps produce light by electrically heating a filament. The color of the light that is emitted depends on the temperature of the filament, but it is usually white. The incandescent lamps that are used in exit signs are designed for significantly longer life than common incandescent lamps.

Fluorescent lamps. Fluorescent lamps produce light when an electric discharge occurs through a low-pressure mercury atmosphere. The discharge generates light and ultraviolet radiation; the ultraviolet radiation is absorbed by the phosphor coating on the walls of the lamp and reradiated as light. The color of the light that is produced is determined largely by the characteristics of the phosphor, but it is usually white. Exit signs use either compact, short linear, or circline fluorescent lamps.

Light-emitting diodes. Light-emitting diodes (LEDs) produce light when low-voltage direct current crosses a suitable semiconductor junction. The color of the light that is produced is determined by the composition of the semiconductor junction. Exit signs typically contain red or green LEDs. Some exit signs use a diffuser to spread the light emitted by the LEDs.

Electroluminescent panels. An electroluminescent panel contains a thin layer of a phosphor-impregnated material that is sandwiched between two layers of conducting material, one of which is clear. The phosphor layer produces light when voltage is applied between the two conductive layers. The luminance depends on the voltage and the frequency of the voltage that is applied. The color of the light is determined by the phosphor that is used. In exit signs, the most common color of light generated is green, but sometimes it is filtered to produce red.

Figure 1. Light Source Technologies Used in Internally Illuminated Exit Signs

Clockwise, from upper left: fluorescent, incandescent, LED, radioluminescent, electroluminescent.

Figure 2a. Exit Sign Formats Tested by NLPIP

Signs displayed in a lit room. From left to right: stencil, panel, matrix.

Figure 2b. Exit Sign Formats Tested by NLPIP

Signs displayed in a darkened room. From left to right: stencil, panel, matrix.

Radioluminescent tubes. Radioluminescent tubes produce light from a phosphor that is irradiated by beta particles emitted by tritium gas. The color of the light is determined by the phosphor that is used; in exit signs the light is usually green. Manufacturers of radioluminescent tubes are licensed by the Nuclear Regulatory Commission in the United States and by the Atomic Energy Control Board in Canada.

Exit signs are also manufactured using photoluminescent materials similar to those used in common, glow-in-the-dark, consumer products. Photoluminescent materials absorb light and reradiate it over time. Photoluminescent signs are not accepted as exit signs by the National Fire Protection Association (NFPA) and thus are not included in this issue of *Specifier Reports.* However, these signs can be used to supplement emergency egress systems that use one or more of the above technologies.

Exit Sign Formats

There are four typical formats for internally illuminated exit signs: edge-lit, matrix, panel, and stencil. The last three are shown in Figures 2a and 2b.

Edge-lit. In an edge-lit sign, light from an enclosed source is directed through a transparent plate that has the letters etched in or attached to its surface. The sign face appears luminous as light leaves the plate. Incandescent, fluorescent, and LED light sources commonly are used for these signs. NLPIP did not study edge-lit signs for this report because none of the manufacturers submitted them as an example of an energy-efficient exit sign.

Matrix. In a matrix exit sign, the letters are formed by points of light. The background (sign face) is opaque. Exposed LEDs are the light source used most commonly in this format.

Panel. In a panel (or open-faced) exit sign, both the letters and the background are luminous. These signs usually use incandescent or compact fluorescent lamps.

Stencil. In a stencil exit sign, the letters are luminous and the background is opaque. Any of the light sources described previously can be used in the stencil format.

Power Supply

The NFPA National Electric Code requires that exit signs operate both with and without utility-supplied power (NFPA 1992). When the utility-supplied power fails, several alternative power supplies are permitted. The three most common are

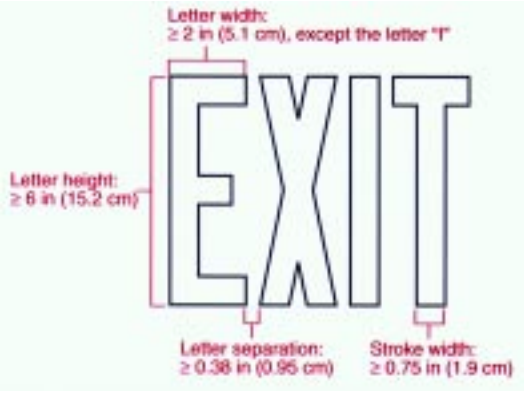
- A generator that supplies power at the same voltage and frequency as the utility;
- A central rechargeable battery unit with or without an inverter that converts direct current into alternating current; and
- An individual rechargeable battery attached to each sign.

NLPIP did not test generators and central battery supply units. The only alternative power supply that this issue of *Specifier Reports* covers is the rechargeable battery attached directly to the exit sign.

Most exit signs use only one light source technology, but some use two, one for use with utility-supplied power and the other, usually incandescent, with the rechargeable battery.

Visibility Standards

Readily visible exit signs are a legal requirement (see sidebar, right). In the United States, what constitutes readily visible exit signs and how they should be applied, are detailed in the NFPA Life Safety Code (NFPA 1991) and in various model building codes, such as the Uniform Building Code published by the International Conference of Building Officials (ICBO 1991). In Canada, the National Building Code is used (National Research Council of Canada 1990). In the NFPA Life Safety Code, exit signs must have plainly legible letters with the following proportionate dimensions:



United States Federal Regulations

United States Occupational Safety and Health Standards (USOSHA 1993) state: "Access to exits shall be marked by readily visible signs in all cases where the exit or the way to reach it is not immediately visible to the occupants . . . . Every required sign designating an exit or way of exit access shall be so located and of such size, color, and design as to be readily visible. No decorations, furnishings, or equipment which impair visibility of an exit sign shall be permitted, nor shall there be any brightly illuminated sign (for other than exit purposes), display, or object in or near the line of vision to the required exit sign of such a character as to so detract attention from the exit sign that it may not be noticed."

Luminance, Luminance Contrast, and Luminance Uniformity

The luminance of a surface is the luminous intensity in a given direction per unit area of that surface as viewed from that direction. It is the photometric equivalent of perceived brightness. Luminance is measured in candelas per square meter (cd/m^2). An older unit for luminance, which is still sometimes used, is footlamberts (1 fL = 3.43 cd/m^2). NFPA Life Safety Code requirements for exit signs are given in footlamberts. NLPIP used cd/m^2 for luminance measurements.

Examples of commonly occurring luminances in an office lit to 50 footcandles (540 lux)

	Footlamberts	cd/m^2
White paper	40	137
Gray carpet	5	17

Luminance contrast quantifies the relative brightness of an object against its background. For an exit sign, the relevant contrast is between the luminance of the letters and the luminance of the rest of the sign face (background). The definition of luminance contrast used in Underwriters Laboratories Standard UL 924 and in this issue of *Specifier Reports* is

$$C = \frac{(L_g - L_l)}{L_g}$$

where C = luminance contrast

L_g = greater luminance

L_l = lesser luminance

Luminance contrast calculated with this formula can vary from zero to one. The closer the luminance contrast is to one, the more visible the letters are against the rest of the sign face.

Luminance uniformity can be defined as the range of luminances of a surface. For exit signs, luminance uniformity of both letters and background is important for the visibility of the sign. For exit signs luminance uniformity is of little concern when the viewer is close to the sign but as the distance of the viewer from the sign increases, uniformity becomes more important for the readability of the sign.

Acronyms for Organizations, Standards, and Codes

Product literature for exit signs may contain the following acronyms of organizations, standards, and codes (country of origin in parentheses).

AECB	Atomic Energy Control Board (Canada)
BOCA	Building Officials and Code Administrators International (United States)
CSA	Canadian Standards Association (Canada)
ICBO	International Conference of Building Officials (United States)
MSHA	Mining Safety and Health Administration (United States)
NBC	National Building Code (Canada)
NEC	National Electrical Code (United States)
NFPA	National Fire Protection Association (United States)
NRC	Nuclear Regulatory Commission (United States)
OSHA	Occupational Safety and Health Administration (United States)
SBCCI	Southern Building Code Conference International (United States)
UL	Underwriters Laboratories (United States)

The NFPA Life Safety Code also requires that every sign be illuminated by a reliable source. Externally illuminated signs (see p. 8, “Alternatives” section) must have a surface illuminance of 5 footcandles (54 lux) and a luminance contrast of not less than 0.50 (see sidebar, left). Internally illuminated signs must have an equivalent or greater visibility than that of an externally illuminated sign lit to 5 footcandles (54 lux). Exceptions are granted for electroluminescent and radioluminescent exit signs that have letters of uniform luminance. The letters of these types of signs must have a minimum luminance of 0.06 footlamberts (0.21 candelas per square meter). Exit signs should be placed so that no point along the access route to an exit is more than 100 feet (30.5 meters) from the nearest visible sign.

Exit signs that mark escape routes may have one or two directional indicators that point to the right, left, or both right and left. The NFPA Life Safety Code specifies the shape and location of these directional indicators and requires that they be identifiable as directional indicators at 100 feet (30.5 meters).

Underwriters Laboratories Standard UL 924 (1991) gives more detailed specifications of the construction, visibility, and performance of exit signs. Exit signs with a UL *listing* have met the criteria in this standard. For retrofit kits, a UL listing implies that when the kit is used in a UL-listed exit sign that contained incandescent lamps, and when it is installed according to the product instructions, it should not adversely affect the operation of the sign. The UL listing of a retrofit kit does not apply to its use in an edge-lit sign nor to its use in exit signs that are powered by a battery in an emergency. A UL-*classified* retrofit kit meets UL 924 when the retrofit kit is installed in a specific exit sign according to the product instructions. Installing a retrofit kit that is not UL-listed, or not UL-classified for the specific sign, invalidates the UL listing of the sign in which the kit is being installed. For both UL-listed and UL-classified retrofit kits, users should follow precisely the instructions that are supplied by the manufacturer.

Other independent testing laboratories sometimes are cited by manufacturers as having “approved” an exit sign. In this case, the specifier should be sure that the exit sign meets all the relevant requirements of UL 924.

Jurisdictions (states, cities, counties, or towns) adopt or modify model codes or develop their own codes. Some jurisdictions have specific requirements for exit signs that change, clarify, modify, extend, or ignore the requirements of the various model building codes. Exit signs that are used in a specific jurisdiction must meet that jurisdiction’s requirements. Thus, specifiers should check with the officials of the relevant jurisdiction before selecting exit signs or retrofit kits.

Options for Specifiers

The federal regulations, the safety and building codes, and UL 924 specify the required construction and operating characteristics of exit signs. Specifiers should also consider other characteristics.

Materials and Construction

Exit signs are available in a wide range of materials. Plastic, fiberglass, aluminum, or steel are used and are either pressed, cast, or extruded. The materials that are used may limit the types of retrofit kits that can be installed in a sign. For example, some retrofit kits cannot be used in some signs constructed of plastic because of possible thermal damage. Materials differ in weight, fire resistance, and ability to withstand physical abuse. Some exit signs are designed to be impact or tamper resistant. Others can be secured with a wire enclosure. UL 924 specifies additional features for exit signs that are to be used in damp or wet locations.

Some exit signs are positioned to be visible from opposite directions. Thus, exit signs are made in both single-faced and two-faced forms. For this report, NLPIP tested only single-faced signs.

Mounting Positions

Exit signs may be recessed into a wall, surface-mounted on a wall or ceiling, or suspended on a pendant. If surface-mounted on a wall, the sign may be placed flat on the wall or perpendicular to it. Manufacturers offer several mounting options.

Color

Many color combinations are available for exit signs. The most common combinations are red or green letters on a white, black, or aluminum background, or white letters on a red or green background. Some jurisdictions limit the choice of color combinations.

NLPIP suggests that specifiers use the same color combination throughout a building to help occupants identify each sign as an exit sign. To avoid confusion, that same color combination should not be used to identify anything other than exits in the building.

Background Finish

The choice of background finish is more than just a matter of preference or style; it is an important determinant of the visibility of the exit sign (see sidebar, “Luminance, Luminance Contrast, and Luminance Uniformity,” on p. 4). For stencil and matrix signs, the luminance of the background is determined by the reflectance of the background surface and by the illuminance provided by the ambient lighting on the face of the sign. Therefore, the luminance contrast of stencil and matrix signs varies with the level of ambient lighting. Variations are smallest for dark backgrounds and largest for white backgrounds. Ambient lighting may also affect the luminance contrast of panel signs but to a lesser degree.

Changes Under Emergency Conditions

Some exit signs are designed so that the luminance of the letters increases when the sign is operated on an alternative power supply. This feature is particularly useful for electroluminescent exit signs because most have a low letter luminance when operated on utility-supplied power.

In an emergency, people must quickly identify their way out of a building. To attract attention, some exit signs flash slowly and/or emit an audible signal whenever the utility-supplied power fails and/or a fire alarm is activated. Some codes and jurisdictions restrict or prohibit the use of flashing or audible signals because it is believed that they may confuse occupants.

Battery Inspection and Maintenance

All exit signs should be inspected at the intervals that are specified by the relevant local jurisdiction. To facilitate this inspection, UL-listed exit signs that are designed to operate from a battery when the utility-supplied power fails must be equipped with a readily accessible test switch and a power supply status display. As noted in Table 1, some signs have sophisticated circuitry that limits battery damage following a battery discharge or a utility brownout.

Selecting Exit Signs

To select an exit sign, the specifier must conform to the requirements of the local jurisdiction. The specifier also must balance cost with the visibility, active power, power quality, reliability, and appearance of the sign.

Installed Cost and Operating Cost

The installed costs of replacement exit signs and retrofit kits vary widely depending on the light source technology used, the quality of the construction, the options selected, and the number of signs purchased.

Installed cost includes both the purchase price of the sign and the cost of installing it. The cost of installing a replacement exit sign is determined mainly by its mounting position and by the amount of wiring or rewiring that must be done. The cost of installing a retrofit kit depends on the ease of access to the exit sign, the difficulty of inserting the kit into the existing sign, and whether or not the kit requires new wiring. Operating costs include energy, lamp replacement, and maintenance costs. The tradeoff between installed cost and operating cost is particularly important when comparing energy-efficient exit signs with less efficient alternatives. Energy-efficient products typically have a higher installed cost, but the difference in installed cost can be recovered over time because they require less energy to operate.

Visibility

The visibility of an exit sign usually is measured by one of the methods described in UL 924. An exit sign that is UL-listed meets the UL visibility requirements, as does an incandescent-type UL-listed exit sign fitted with a UL-listed retrofit kit according to the kit manufacturer's instructions. Specifiers should note that an incandescent-type exit sign fitted with a UL-classified retrofit kit may not meet the visibility requirements of UL 924, unless the sign in which it is installed is one for which the UL-classified status was approved and the kit manufacturer's instructions are followed precisely. NLPIP developed a readability test for exit signs that is described in the section starting on p. 11; the results are given in Tables 3 and 4.

Signs that meet the UL 924 visibility standard are tested in a clear atmosphere. Surprisingly, no visibility standard exists for a smoke-filled atmosphere, an emergency situation for which the visibility of exit signs is critically important. Studies show that the luminance of the sign is the major determining factor for visibility through smoke: the higher the luminance of the sign, the better the visibility of the sign in smoke (Rea *et al.* 1985; Collins *et al.* 1990; Ouellette 1993). NLPIP evaluated the visibility of exit signs in smoke using a smoke simulation computer program described in the section starting on p. 13; the results are given in Tables 5 and 6. None of the exit signs that NLPIP tested were visible at 100 feet (30.5 meters) through gray smoke.

Active Power and Power Quality

Active power is measured in watts; apparent power is the product of the root-mean-square (rms) voltage and current and is measured in volt-amperes. The apparent power and the active power are related by the power factor as follows:

$$\text{Power Factor} = \frac{\text{Active Power (watts)}}{\text{Apparent Power (rms volt-amperes)}}$$

For an electrical device in which the voltage and current are in phase and have identical waveforms, the power factor is unity. If the voltage and current waveforms are not in phase and/or their waveforms are not identical, the power factor will be less than one.

The active power of an exit sign, combined with its hours of use, determines its billed energy consumption and hence affects its operating cost. Apparent power can influence operating costs for customers who also are billed for peak demand, which often is measured in kilovolt-amperes (kVA).

Root-Mean-Square (rms)

The term *root-mean-square* refers to the procedure that is used to calculate the average value of a periodic waveform, such as voltage or current. Mathematically, it is the square root of the mean of the squared values, volts or amps, taken over one complete cycle. Thus, the term *rms voltage* expresses the average voltage.

Mounting Height of Exit Signs

During a fire, smoke does not fill a building uniformly. Often, the smoke is densest near the ceiling and least dense close to the floor. Emergency instructions encourage people to crouch or crawl along the floor. Thus, it may seem odd that exit signs are usually mounted above head height rather than close to the floor. However, mounting the sign above head height has two advantages. First, the sign does not project into the escape route, even if it is mounted perpendicular to the wall. This limits potential harm to occupants from bumping into the sign and limits damage to the sign from accidental or intentional contact. Second, people's view of the sign is not likely to be obstructed by furnishings or other people. The NFPA Life Safety Code requires that, in some applications, an additional exit sign be positioned close to the floor. Some exit signs provide both high- and low-level mounting for two electrically connected signs; one sign (the master) contains all the power and control circuitry to drive the other (the slave).

For safety reasons, specifiers also should consider the influence of the power factor on the current-carrying capacity of the emergency power supply and its associated conductors. For a given active power, an exit sign with a low power factor will draw more current than an exit sign with a high power factor. When replacing an existing exit sign, specifiers should ensure that the replacement exit sign or retrofit kit does not cause the current to exceed the current-carrying capacity of the existing emergency power supply and its conductors. Excess current can cause wires to overheat, which is a fire hazard, or it can affect circuit breakers or controls.

Although the impact of a low power factor device on the circuit current is important, the influence of an exit sign's power factor on the building electricity supply rarely needs to be considered. The active power of exit signs during normal power supply conditions is a small percentage of the total power demand in a building, so even a very low power factor has little influence on the overall power quality. Thus, exit signs that have low power factor will seldom result in utility penalty changes for the overall building power factor. However, if the exit signs are operating on power from a generator or a central battery/inverter system, the exit signs can form a significant part of the load on the building's emergency electrical system. The electrical distortion inherent in a low power factor could affect the control of that system.

NLPIP measured the active power, apparent power, and power factor of exit signs and retrofit kits. These measurements are described on p. 11 and results appear in Tables 3 and 4.

Reliability and Maintenance

The reliability of an exit sign depends on the light source technology and the maintenance procedures for the sign. Generally, fluorescent lamps last one to two years, whereas electroluminescent, radioluminescent, and light-emitting diodes last five years or more. Light-emitting diodes have the longest life. The rated life of incandescent lamps used in exit signs varies from two to twenty years. For light source technologies that have lives of a decade or more, the power circuitry may fail before the light source.

Lamp failure is a common problem for exit signs. To maintain the integrity of the emergency egress system in the event of lamp failure, some jurisdictions require two lamps in each sign, operating simultaneously. Some retrofit kit manufacturers address the lamp failure concern by including two lamps that operate successively, so that if one lamp fails, the other will operate.

Proper maintenance of exit signs requires inspecting them at regular intervals, replacing failed lamps, and correcting any other faults that are discovered. The NFPA Life Safety Code requires monthly inspections by the building's owner or a person designated to be responsible. If the sign has a battery power supply for use in emergencies, the monthly inspection should include a 90-second battery operation check. Once a year, the NFPA Life Safety Code requires that each exit sign equipped with a battery be operated on the battery for 90 minutes. The results of all inspections should be recorded so that they can be reviewed by the appropriate authority.

Only radioluminescent exit signs require no maintenance other than cleaning. However, the entire sign must be replaced by a certain date because the luminance decreases over time. These signs contain very small quantities of radioactive material that emit beta rays, so at the time of purchase the manufacturer should be consulted about appropriate methods of handling and disposal. In the United States, disposal of radioluminescent signs is limited to transfer to organizations that are licensed by the Nuclear Regulatory Commission.

Warranties

Most manufacturers of exit signs and retrofit kits provide warranties for their products that apply to specific signs. This means that placing a retrofit kit into an existing exit sign may invalidate the warranty of the sign in which it is installed. Manufacturers should be consulted if this is a concern.

Appearance

Architects and designers often prefer exit signs that have a neat and unobtrusive appearance and an external finish that coordinates with other building finishes. Specifiers should therefore preview exit signs before installation to evaluate their appearance. This is also important before installing retrofit kits because the outward appearance of the sign may change after the retrofit kit is installed.

Using Retrofit Kits

- Prior to placing a large order, install a sample retrofit kit to establish the ease of installation and to make sure that the sign will be acceptable to the officials of the relevant jurisdiction.
- Retrofit kits installed in exit signs with a high-reflectance (white) interior will generally provide a greater sign luminance than if used in signs with a low-reflectance (black) interior.
- Order retrofit kits with connectors that match the sockets of the existing signs to ease installation.
- Ensure that the sign's apertures, such as the letters and any downlights, are not blocked by components of the retrofit kit.
- Some retrofit kits use incandescent light sources that are distributed along a flexible transparent pipe. Follow the manufacturer's template when aligning the pipe in the sign.

Interior of exit signs, showing retrofit kits. Clockwise, from upper left: side-mounted LEDs, compact fluorescent lamp, electroluminescent panel, incandescent light tube, incandescent lamps, LED replacement faceplate.

Retrofit kits installed in host sign. Clockwise, from upper left: side-mounted LEDs, compact fluorescent lamp, electroluminescent panel, incandescent light tube, incandescent lamps, LED replacement faceplate.

Alternatives

Federal regulations require that exits and routes to exits be marked by readily visible signs. The alternative to the internally illuminated signs evaluated in this issue of *Specifier Reports* is externally illuminated signs. They are illuminated by a light source that is not part of the sign. Typically, such a light source is a luminaire that is used continuously as part of the building's lighting system and one that can light the escape route during an emergency. When deciding between internally and externally illuminated exit signs, specifiers should consider the signs' power consumption and its visibility in smoke.

The power consumption of externally relative to internally illuminated exit signs depends on the specific building situation. If the required location of the exit sign is close to an external light source, which is always on, the externally illuminated sign uses less power because the external light source must also be present even if an internally illuminated sign is used. Such positioning is unusual. If a special luminaire is required to provide the external illumination, an internally illuminated exit sign generally will use less power.

The visibility of externally illuminated exit signs in smoke usually is lower than that of internally illuminated signs because the light from the external light source is absorbed and scattered before it reaches the face of the sign.

Performance Evaluations

Manufacturers' Data

NLPIP identified manufacturers of exit signs through equipment directories and advertisements in *Lighting Design + Application* and *Energy User News* and invited them to participate in this project. Those who agreed to participate were given detailed information about the project and were asked to complete data sheets for their energy-efficient,

internally illuminated, single-faced exit signs and their retrofit kits. In addition, NLPIP asked each manufacturer to provide product literature and one sample of each of the exit signs and retrofit kits for which data sheets were submitted. Samples were accepted until January 31, 1993.

Twenty-six manufacturers submitted information and samples; 28 different exit signs and 28 different retrofit kits were received. Some manufacturers make both exit signs and retrofit kits. Others make only exit signs or only retrofit kits. Some manufacturers supplied exit signs with a battery power supply; others did not.

Table 1 summarizes the information that was supplied by manufacturers for exit signs. The information is categorized by the light source technology that the sign incorporates. Table 1 also shows the options that are available with each exit sign. According to the manufacturers, all the exit signs in Table 1 have been tested to conform with UL 924 by Underwriters Laboratories or an equivalent testing laboratory. Table 2 summarizes the information that was supplied by the manufacturers for retrofit kits, including their UL status.

NLPIP Evaluations

NLPIP evaluated four aspects of the manufacturer-donated exit signs and retrofit kits: photometric characteristics, power characteristics, readability of the sign, and visibility of the sign in smoke. These evaluations were first performed between February and May 1993. The evaluation of the signs' visibility in smoke was revised between June and September 1994. All evaluations were performed at the Niagara Mohawk Lighting Research Laboratory in Watervliet, New York.

The exit signs were evaluated as supplied by the manufacturer. If a battery power supply was submitted with the exit sign, the evaluations of its photometric characteristics and its visibility in smoke were conducted twice: with the sign operating on utility-supplied power and on battery power. All other evaluations were conducted with the exit sign operating on utility-supplied power only.

The majority of the retrofit kits were installed in the same model host sign, the Lithonia Emergency Systems Quantum Model M (catalog number QMSW3R120), following the retrofit kit manufacturers' instructions. This model has a white plastic, single-faced housing; its stenciled letters are backed by a red filter. It operates two 12-watt incandescent lamps on 120 volts. The host sign was evaluated by NLPIP for comparison purposes; thus, a total of 57 signs and retrofit kits were tested.

This model was selected as the host sign because it easily accommodates retrofit kits and because the high reflectance of its white interior enhances the letter luminances.

One electroluminescent retrofit kit was installed in a host sign, but the red filter was not used because the electroluminescent retrofit kit emitted green light. Two LED retrofit kits were already mounted on white plates. These plates are designed to replace or cover the existing face of a sign, so they were evaluated as supplied, not installed in a host sign.

Photometric characteristics. The luminance, luminance contrast, and luminance uniformity of an exit sign affect its visibility (see sidebar, "Luminance, Luminance Contrast, and Luminance Uniformity," on p. 4). To evaluate these photometric characteristics of 53 exit signs and retrofit kits, NLPIP used a CapCalc imaging photometer (see sidebar, at right). NLPIP used a Minolta LS 100 luminance meter to evaluate the four radioluminescent signs because the luminances of these signs were close to the absolute sensitivity limits of the imaging photometer (CapCalc).

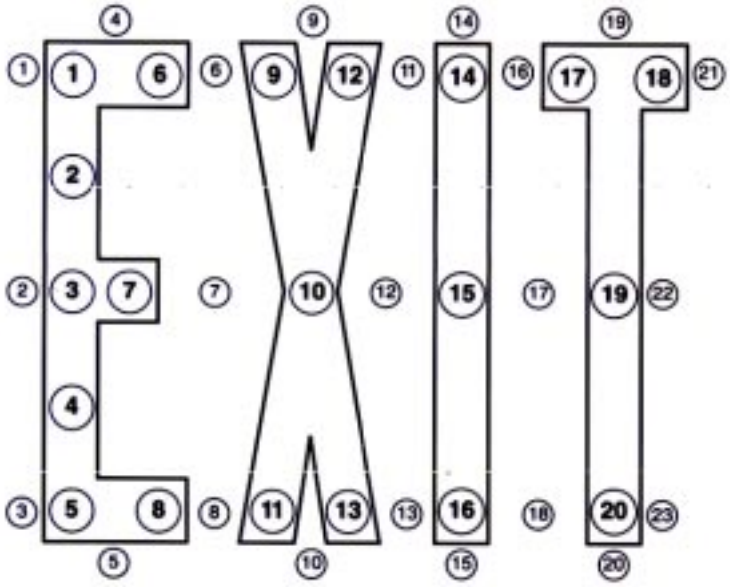
Before measuring luminances with CapCalc, NLPIP operated the 53 products on utility-supplied power for a minimum of 100 hours and a maximum of 1000 hours. This was done to season the light sources and to fully charge any batteries. Then, every exit sign and retrofit kit was placed upright on a horizontal platform against a background of black cloth. Measurements were made with the room lights turned off, to simulate the luminance of the sign during a power interruption. To protect against fluctuations in the utility-supplied power, the products were operated on a regulated 120-volt ac power supply. The stability of the applied voltage was ±0.1 volt. All the products were operated for at least 20 minutes immediately prior to being placed on the measurement platform. Once on the platform, all products were operated for 5 minutes before luminance measurements were taken.

A similar warm-up procedure was used for battery-operated exit signs, but the luminance pattern of the sign was measured 1 minute after switching to the battery

The CapCalc Imaging Photometer

The CapCalc imaging photometer uses a black and white videocamera interfaced with a computer to instantaneously capture the luminance values of all the pixels within the camera's field of view. CapCalc can report the luminance of any individual pixel or report the average luminance of any selected area within the image. Due to the limits of the videocamera, CapCalc cannot accurately measure low luminances, such as those produced by radioluminescent-type exit signs.

Figure 3. Template Used for Locating Positions for Average Luminance Measurements (Adapted from UL 924)



power supply. NLPIP did not evaluate the battery-powered exit signs as the battery discharged over time.

To record the luminance patterns of the sign faces, CapCalc's video camera was focused on the face of the incandescent, fluorescent, electroluminescent, and LED-type exit signs and retrofit kits.

NLPIP measured the luminances of 43 circles positioned on the sign face (shown in Figure 3) according to the visibility measurement procedures in UL 924. Twenty circles positioned on the letters and 23 circles positioned on the immediate background of every sign were measured.

To record the luminances of the radioluminescent exit signs, each sign was mounted upright on a horizontal platform surrounded by a black cloth. With the room lights off, the Minolta LS 100 luminance meter was focused on the face of the sign and the luminances of the 43 circles were recorded.

For each sign, the mean luminance for the letters was calculated from the luminances of the 20 circles positioned on the letters in Figure 3. The mean luminance of the background was calculated from the luminances of the other 23 circles. These mean luminances were used to calculate the luminance contrast of the letters against the background, using the definition given in the sidebar on p. 4. The range of luminances within the letters (letter luminance range) was determined by the lowest and highest luminances of the 20 circles positioned on the letters. The range of luminances for the background (background luminance range) was determined by the lowest and highest luminances of the 23 circles positioned on the background.

Tables 3 and 4 list the mean luminances of the letters and the background, the range of luminances occurring within the letters and within the background, and the luminance contrast between the letters and their background, for each sign operated on the regulated power supply and, if available, on battery-supplied power. Table 3 lists the data for the exit signs. Table 4 provides data for the retrofit kits. The measured data for the host sign, prior to installing a retrofit kit, are given at the top of Table 4 for comparison purposes. The trends in the data listed in Tables 3 and 4 are summarized in the table to the left.

When some of the exit signs were operated on battery-supplied power, the mean letter luminance increased, compared to

Summary of Photometric Measurements from Tables 3 and 4

	Exit Signs on Regulated Power Supply (Table 3)	Retrofit Kits (Table 4)
Mean letter luminance (in decreasing order by light source)	circline fluorescent, compact fluorescent, LED*, incandescent, electroluminescent, radioluminescent	compact fluorescent, LED*, incandescent, electroluminescent
Mean background luminance	Low for the 25 stencil and matrix signs; high for the three panel signs.	Low for all kits in the stencil host sign.
Luminance contrast of the letters against background	High for all the signs (all but one were greater than 0.80).	High for all kits (all kits were greater than 0.90).
Range of letter luminance (in increasing order by light source)	radioluminescent and electroluminescent, LED and incandescent, circline fluorescent, compact fluorescent	electroluminescent, LED, incandescent, compact fluorescent

* The luminances of the LED signs can vary substantially because of the differing number and type of LEDs in each measurement area of each sign and the characteristics of any diffuser present.

operation on utility-supplied voltage. Most notably, all the electroluminescent signs showed a marked increase in mean letter luminance after switching to battery power.

Power measurements. NLPIP measured the active power, power factor, and apparent power of the exit signs and retrofit kits using the following procedure. All the signs already had been operated on utility-supplied power for 100 to 1000 hours. When the active power measurements were made, each sign without an installed battery pack was operated on utility-supplied power for at least 20 minutes immediately before the measurements were taken. Exit signs with a battery pack were operated on utility-supplied power for at least 1 hour before measurements were taken. Each sign was then connected to a regulated power supply and operated for at least 5 minutes. The input voltage to the sign was 120 ± 0.1 volts. For each sign, NLPIP measured the magnitude and waveform of the voltage and current, and the phase relationship between them. Then the active power, power factor, and apparent power were calculated from the measured values. Table 3 lists the active power, power factor, and apparent power of each exit sign. Table 4 lists these parameters for each retrofit kit and for a host sign prior to being fitted with a retrofit kit.

Tables 3 and 4 show a wide range of measured active power. The radioluminescent exit signs consumed the least amount of active power (0 watts). One of the compact fluorescent exit signs consumed the most (29 watts). Measured power factor, and hence apparent power, also varied widely.

Readability. Readability of an exit sign is defined as whether or not a person can read and understand the message of an exit sign. Several factors affect the readability of an exit sign:

- Letter size and spacing;
- Luminance of the letters;
- Luminance contrast between the letters and the background;
- Color difference between the letters and the background; and
- Luminance uniformity within the letters and within the background.

NLPIP evaluated the combined effect of these variables on the readability of the exit signs and retrofit kits by asking subjects to identify the orientation of the word “EXIT,” using the procedure described below.

Each sign (exit signs and retrofit kits) was presented to the subject at a height of 5.5 feet (1.67 meters) above the floor at the end of a straight corridor, 165 feet (50 meters) long (see Figure 4). The windows along the corridor were covered with an opaque material. Each sign was placed on a horizontal platform containing two mirrors mounted vertically and at 90° to one another (see Figures 5a and 5b). The floor of the platform was painted matte black and the sides were covered with black cloth. By placing the sign in different positions in front of the mirrors (right-side-up or upside-down, in positions A or B in Figure 5a), the word “EXIT” appeared to the subject in one of the four orientations shown in Figure 6. NLPIP quantified the readability of the exit sign by measuring the distance from the sign at which the subject correctly identified the orientation of the word “EXIT.”

Figure 4. Layout for NLPIP's Readability Evaluation

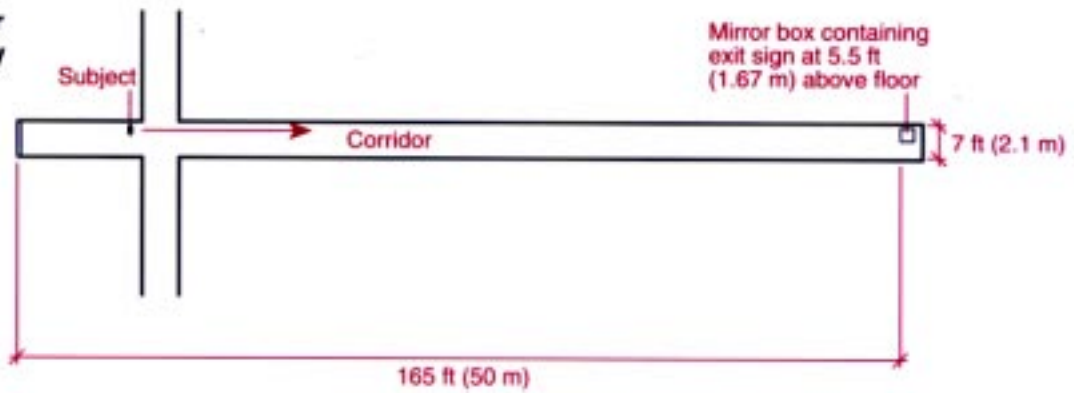


Figure 5a. Plan View of Mirror Box Used for Changing Orientation of Signs

Each sign was placed at either position A or B.

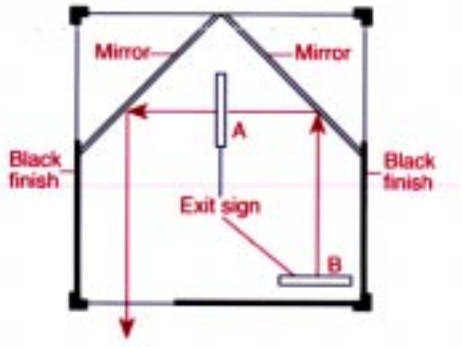


Figure 5b. An NLPIP Researcher Adjusts a Sign in the Mirror Box

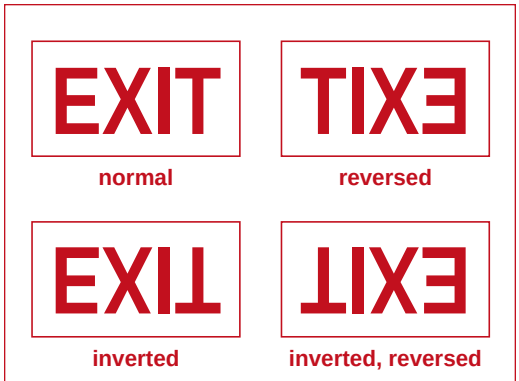


Figure 6. The Four Orientations of the Word "EXIT" Viewed by the Subjects

Every sign was viewed twice by every subject, first with the corridor lights turned on, and then, on a different day, with the lights turned off. The average illuminance on the floor of the corridor when the corridor lighting was turned on was 32 footcandles (340 lux). The average illuminance on the floor of the corridor when the corridor lighting was turned off was less than 0.03 footcandles (0.3 lux). For both lighting conditions, the signs were operated on utility-supplied power.

Fourteen people, ages 23 to 56, participated in the readability measurements. They all had a corrected distance visual acuity better than 20/30, as measured on a standard distance Snellen letter visual acuity chart lit to 23 footcandles (250 lux) viewed from 20 feet (6.1 meters), and normal color vision as measured by the Ishihara test for color blindness (Ishihara 1964).

To begin the measurement procedure, each subject adapted to the corridor lighting for 5 minutes. Then, starting from a distance of 165 feet (50 meters), the subject viewed the sign. The subject walked toward the sign and stopped when he or she was confident that the orientation of the word "EXIT" could be identified. If the subject correctly identified the sign's orientation, the distance was recorded as the measure of the sign's readability. If the identification was incorrect, the subject was informed and asked to continue moving toward the sign. This process continued until the subject identified the orientation correctly. The subject then walked back along the corridor to the starting point. The procedure was repeated for the next sign and continued until all the exit signs and retrofit kits were viewed.

For each subject, the signs were presented in random order. The position of the signs relative to the mirrors was also random, except for the signs that use compact fluorescent lamps. These signs had to be viewed right-side-up because the light output of these lamps changes when they are inverted. Subjects were not aware of this restriction on position.

The results of the readability measurements for the exit signs are given in Table 3, and results for the retrofit kits are in Table 4.

Also shown at the top of Table 4 is the readability of the host exit sign, prior to having a retrofit kit installed. The readability is expressed as the number of subjects who could not correctly read the orientation of "EXIT" at 100 feet (30.5 meters) and 150 feet (45.7 meters), with the corridor lights off and on. For example, a "2" in the 150 feet column means that two of the 14 subjects were unable to read the orientation correctly at 150 feet.

There were distinct differences among the different light source technologies for readability at 100 feet. Also, there were differences among signs using the *same* light source technology for readability at 150 feet. Some signs were more difficult to read when the corridor lights were turned on, and others were easier. This difference probably was due to the effect of the corridor illumination on the luminance contrast of the sign.

Calculated luminances and luminance contrast through smoke. None of the standards that are applied to exit signs consider their visibility in smoke. Obviously, fire and smoke can cause an emergency that requires the rapid evacuation of a building. Thus the visibility of exit signs in smoke is crucial.

The visibility of exit signs in smoke is affected by:

- The extent to which the light is absorbed or scattered by the smoke, and
- Visual factors including the irritating effect the smoke has on the eye.

In this issue of *Specifier Reports*, NLPIP used a mathematical model to evaluate the effect of smoke on the visibility of exit signs (see sidebar, at right). The model incorporates the absorption and scattering of light from the exit sign but not the irritating effect of smoke on the eye.

The application of this model has four stages. First, the luminance pattern produced by each exit sign or retrofit kit, in a clear atmosphere, with the room lights turned off, and operating on the regulated power supply, was measured with CapCalc as described in the "Photometric characteristics" section on p. 9. For exit signs with a battery, the luminance pattern of the sign operating on battery-supplied power also was measured as described on p. 9.

Second, the Smoke-Sim computer software package was applied to the clear-air luminance pattern to predict the luminance pattern through gray smoke, at distances of 3.28, 6.56, 16.4, 23.0, 32.8, and 39.4 feet (1, 2, 5, 7, 10, and 12 meters).

Third, the mean letter luminance, the mean background luminance, and the luminance contrast after passing a given distance through the defined smoke were calculated for the 53 exit signs and retrofit kits that were evaluated with CapCalc. The measurement points that were used in the calculation of mean letter and background luminances were the same as those used in the absence of smoke (Figure 3). The radioluminescent exit signs were not included in this evaluation because the Smoke-Sim software requires a CapCalc image as its input data and the luminances of these signs were too low to be measured accurately with CapCalc.

Fourth, the photometric information was used to calculate the distance at which the mean letter luminance or mean background luminance, whichever was greater in a clear atmosphere, dropped to 0.06 fL (0.21 cd/m^2). This value is the minimum letter luminance permitted by the NFPA Life Safety Code for electroluminescent or radioluminescent exit signs.

Table 5 lists the results of these calculations for the exit signs. Table 6 lists the results for retrofit kits. At the top of Table 6 are the results for the host exit sign before retrofit kits were installed. The following data are reported in Tables 5 and 6:

- The mean letter luminance, the mean background luminance, and the luminance contrast of the exit signs and retrofit kits, operating on a regulated power supply and, if available, a battery power supply, measured in a clear atmosphere (in clear-air conditions, these luminances will not significantly decrease over the relevant distances);

Modeling the Effects of Smoke

Optically, smoke is an aerosol like fog. Aerosols absorb and scatter light, reducing luminance and blurring any object seen through them. Visibility through aerosols has been studied extensively in order to improve the effectiveness of satellite and aerial reconnaissance.

Full details of a mathematical model of the absorption and scattering of light by aerosols can be obtained from Lutomirski (1978) and Kopeika (1985). Bierman *et al.* (1994) detail how this model was applied to exit signs and how it was validated as it applies to smoke. NLPIP applied the model to exit signs using Smoke-Sim, a software application developed by the Lighting Research Center. The characteristics of the smoke that NLPIP used in this model, and the basis for the calculations, are described on p. 16.

Smoke-Sim © Rensselaer Polytechnic Institute

- The mean letter luminance, the mean background luminance, and the luminance contrast of the exit signs and retrofit kits operating on a regulated power supply and, if available, a battery power supply, calculated for passage through a uniformly filled volume of the defined smoke, at a distance of 16.4 feet (5 meters); and
- The critical distance, defined as the distance through a uniformly filled volume of smoke at which the mean letter luminance or the mean background luminance, whichever is greater in a clear atmosphere, drops to 0.06 fL (0.21 cd/m^2).

Smoke simulation results. The following observations summarize the data reported in Tables 5 and 6. These results should be considered indicative rather than definitive because the calculations were done for only one type of smoke. The sidebar on p. 16, "Using Smoke-Sim to Predict Exit Sign Visibility," describes the effects that can be predicted if the characteristics of the smoke are changed.

- As expected, the smoke strongly reduced the mean letter and mean background luminances.
- In the smoke, all the signs had mean letter and background luminances of less than 0.06 fL (0.21 cd/m^2) at distances greater than 41 feet (12 meters).
- The luminance contrast of all the signs (those for which luminance contrast could be calculated) was reduced in smoke; reduction was greatest for the panel-format signs.
- The letter luminances of the electroluminescent-type exit signs operated on the regulated power supply decreased to the 0.06 fL (0.21 cd/m^2) luminance at shorter distances than the other light source technologies. The electroluminescent-type signs had higher luminances when battery-operated and thus decreased to the 0.06 fL (0.21 cd/m^2) luminance at greater distances than when they were operated on the regulated power supply.
- The critical distances are primarily determined by the letter and background luminances without smoke; the higher the luminances, the greater the critical distance.
- The critical distances are probably underestimated for the LED-type signs with no diffuser because the letter luminances that were used were luminances averaged over the circles specified in UL 924 (Figure 3). These circles are larger in size than the individual light-emitting diodes. In smoke, the higher luminance of the individual light-emitting diodes would likely remain visible at greater distances. To check the magnitude of this effect, NLPIP performed the calculations again for three LED-type signs with no diffusers using the luminances of the light-emitting diodes themselves, rather than the average luminance over the area of the circles. The result was an increase in critical distance of approximately 2.3 feet (0.70 meters).
- Although the radioluminescent stencil exit signs were not included in these calculations, the low letter luminances of these signs in clear air (see Table 3) suggests that their letter luminances would drop below 0.06 fL (0.21 cd/m^2) at relatively short distances in smoke.

Data Tables

The following data tables present information that was supplied by manufacturers (Tables 1 and 2) and data that were collected by NLPIP researchers using the methods described in the "NLPIP Evaluations" section (Tables 3, 4, 5, and 6). All luminance values are reported in candelas per square meter (cd/m^2). For users more familiar with footlamberts (fL), the conversion factor is 1 cd/m^2 = 0.29 fL. Unless otherwise indicated, all measured data are for the signs operating on regulated utility-supplied power. Most of the column headings for these tables are self-explanatory; those that are not are defined below.

Auto discharge/recharge cycle: Indicates whether or not the sign has a circuit that is designed to discharge and recharge the battery at regular intervals. This is an option for some signs. Proponents of this technology claim that it extends battery life. NLPIP did not test this claim.

Battery-operated: In any column heading in Tables 3 and 5, "battery-operated" indicates that the exit sign was operated on its own rechargeable battery when the reported data were collected.

Battery mode: Indicates whether or not an option exists for equipping the exit sign with its own battery. An exit sign that does not have a battery could still be operated on a generator or a central battery unit during an emergency. UL-listed exit signs that have a battery also must include a battery test switch and a battery/power supply status indicator.

Battery operating time: The time for which the battery could operate the exit sign and still fulfill UL 924 requirements.

Battery recharge time: The time required to recharge the battery sufficiently (after a 90-minute discharge) so that it could operate the exit sign for 1 hour. UL 924 allows a maximum battery recharge time of 24 hours.

Brownout circuitry: Indicates whether or not the sign has a circuit that is designed to switch over to battery supply if the voltage of the utility-supplied power drops below a specified value. This is an option for some signs.

Emergency options: Refers to options available when signs are operated on a non-utility power supply, such as a generator, a central battery unit that operates several exit signs, or an individual rechargeable battery. Options include

Increased sign luminance: Indicates whether or not the exit sign increases the brightness of the light source if the utility-supplied power fails.

Flash: Indicates whether or not the sign flashes on and off when the utility-supplied power fails and/or a fire alarm circuit is activated.

Flash and buzz: Indicates whether or not the sign flashes on and off and produces an auditory signal when the utility-supplied power fails and/or a fire alarm circuit is activated.

Low battery voltage disconnect: Indicates whether or not the sign has a circuit that is designed to disconnect the battery after it is discharged; this prevents damage to the battery. This is an option for some signs. Lead acid and lead calcium batteries need this circuit but nickel cadmium batteries do not.

Luminance contrast: Defined in the sidebar on p. 4.

Rated lamp life: Lamp life in Tables 1 and 2 is given in years (instead of hours). To convert lamp life from hours into years, NLPIP assumed that the lamp would be used 24 hours a day, 365 days a year. Fluorescent lamps may last longer than rated life, because life ratings are based on a three-hour burning cycle. Under continuous operation, fluorescent lamp life may be extended by as much as 80 percent.

Smoke: In any column heading in Tables 5 and 6, "Smoke" indicates that data were obtained from simulations of the sign's appearance through a uniform gray smoke. The characteristics of the smoke are described on p. 16.

UL 924 Status: In Table 2, this column indicates whether a retrofit kit is UL-listed, UL-classified, or tested. UL-listed and UL-classified are defined on p.4; "tested" means that the product has been tested to the appropriate UL 924 requirements by an independent laboratory.

Appendix: Basis for smoke calculations

Smoke both absorbs and scatters light, so an exit sign seen through smoke is reduced in luminance and blurred in appearance.

To mathematically model the effect of smoke on the spatial-luminance characteristics of an exit sign, NLPIP used a modulation transfer function (MTF) approach. This approach is used widely in physical optics to characterize the fidelity of optical systems, such as lenses. The MTF describes how the spatial characteristics of the object are modified by an optical system. In the model, smoke is considered to be an optical system composed of an aerosol made up of particles of the same size that are uniformly distributed along a path of a given length.

The general aerosol MTF used by NLPIP has been described by Lutomirski (1978) and applied by Kopeika (1985). The mathematical function is beyond the scope of *Specifier Reports* but is given in the above-mentioned papers and in Bierman *et al.* (1994). Factors in the equation include the size of the smoke particles, the distance from the observer to the object, and coefficients for scattering and absorption.

For this project, NLPIP simulated a gray smoke with the absorption and scattering characteristics of smoke generated by evaporating mineral oil (absorption = 0.60/m, scattering = 0.20/m, particle size = 25 μm).

The application of the smoke's MTF to an exit sign's luminance pattern involves three steps. First, the luminance pattern of the exit sign measured in a clear atmosphere is converted into its spatial frequency distribution by means of a Fourier transform. The spacial frequency distribution describes the luminance pattern in terms of the rapidity and magnitude of luminance variations in the pattern. A sharp border or edge in the image is interpreted as a high-frequency signal. Gradual shifts in luminance, such as in a blurry image, are interpreted as low frequency signals.

In the second step, the MTF of the smoke is applied to the spatial frequency distribution of the exit sign measured in a clear atmosphere, resulting in a modified spatial frequency distribution. The MTF models the absorptive characteristic of smoke by reducing the magnitude of the spatial frequencies. The blurring effects of the smoke's scattering characteristics are modeled by attenuating the high spatial frequencies.

In the third step, the luminance pattern of the exit sign after it passes through the smoke is constructed from the modified spatial frequency distribution by applying an inverse Fourier transform.

NLPIP implemented this mathematical model of the absorption and scattering of light by smoke in the Smoke-Sim software package.

Using Smoke-Sim to Predict Exit Sign Visibility

Although the calculations of visibility through smoke summarized in Tables 5 and 6 were done for one type of smoke, the effects of different types of smoke can be predicted from changes in the parameters that were used in the calculation.

If the density of the smoke were increased (for the same ratio of absorption to scattering), the mean luminances of the letters and background would decrease so that the distances at which the higher luminance (letter or background) falls below 0.06 fL (0.21 cd/m^2) also would decrease. However, the visibility of each sign relative to all the others would remain constant.

If the ratio between the absorption and scattering coefficients of the smoke were changed, then both the absolute mean luminances and the relative visibility of the exit signs and retrofit kits would change. How much they would change depends on the relative strength of the absorption and scattering of light.

If a perfectly black smoke (one that absorbs but does not scatter light) were used, the visibility of the sign would be determined primarily by the maximum luminance of the letters or the background. The greater the letter or background luminance without smoke, the greater the distance at which the exit sign would remain readable in smoke.

If a perfectly white smoke (one that scatters but does not absorb light) were used, the visibility of the sign would be determined primarily by the luminance contrast of the sign. The greater the luminance contrast without smoke, the greater the distance at which the sign would remain readable in smoke. Few types of common fires create such smoke; most create smoke with some absorptive characteristics that will decrease luminance. To simulate both absorption and scattering effects, NLPIP used a gray smoke for the computer simulations of visibility in smoke. Tables 5 and 6 include NLPIP's measurements of luminance contrast for exit signs and retrofit kits in clear air and in simulated gray smoke.

Computer simulation of the visibility of exit signs in smoke. From top to bottom, the types of exit signs shown are electroluminescent stencil, compact fluorescent stencil, LED matrix, and incandescent panel. From left to right, the simulation shows the original sign (no smoke) and the sign "viewed" from 6.56 feet (2 meters), 16.4 feet (5 meters), and 23.0 feet (7 meters) in gray smoke. The brightnesses of the different types of signs were balanced to make them roughly the same in the clear-air condition; thus the apparent brightnesses of the different sign types should not be compared with each other.

Table 1. Manufacturer-Supplied Information: Exit Signs (listed by type of light source)

Manufacturer	Trade Name	Number of Light Sources	Rated Active Power (W) at		Power Factor at		Rated Lamp Life (yrs)	Battery Mode	Battery Type	Battery Operating Time (hrs)	Battery Recharge Time (hrs)	Low Battery Voltage Disconnect	Brown-out Circuitry	Auto Discharge/ Recharge Cycle	Emergency Options (a)	Sign Format	Available Color(s) of Letters	Available Color(s) of Background	Housing Material	Weight (lbs)	Mounting	Impact Resistant	Tamper Resistant	Warranty Period (yrs)	Warranty on Internal Battery (yrs)
			120V	277V	120V	277V																			
Circline Fluorescent																									
Beghelli Inc.	Pratica Bella Exit	1	22.0	22.0	0.90	0.90	1.4	yes	lead acid 6V	2.5	24	yes	yes	yes	no	panel	white	green, red	plastic (polycarbonate)	5.3	ceiling, wall	yes	yes	3	3
Compact Fluorescent																									
Hetherington Industries, Inc.	Series 132	2	15.0	20.0	0.55	0.45	1.1	no	N/A	N/A	N/A	N/A	N/A	N/A	(b)	stencil	green, red	aluminum	steel	3.0	ceiling, wall	no	no	1	N/A
INCON INDUSTRIES INC.	INCON	1	9.0	9.0	0.45	0.45	1.1	no	N/A	N/A	N/A	N/A	N/A	N/A	no	stencil	green, red	white	plastic (polycarbonate)	5.0	ceiling, wall	yes	no	2	N/A
KENALL	TRAILMATE	2	16.0	16.0	0.40	0.23	1.1	yes	lead calcium 6V	1.5	24	yes	yes	yes	flash, flash and buzz (b)	panel	green, red	white	plastic (polycarbonate)	5.0	ceiling, wall	yes	yes	3	1
Lithonia Lighting	Titan Fluorescent	2	16.0	20.0	0.42	0.24	1.7	yes	lead calcium 6V	1.5	24	yes	no	no	flash, flash and buzz (b)	stencil	green, red	black, white	steel	6.0	ceiling, pendant, wall	no	yes	3	3
Radiant Illumination Inc.	NXL “Excellence” (c)	2	25.7	25.7	0.75	0.75	0.85	yes	nickel cadmium 7.2V	2.0	12	yes	yes	no	flash	panel, stencil	green, red, white	aluminum, green, red, white	die cast aluminum	8.0	ceiling, pendant, recessed, wall	no	no	1.5	5
Radiant Illumination Inc.	VX “Vandal Proof” (c)	2	21.7	21.7	0.33	0.33	0.85	yes	nickel cadmium 7.2V	2.0	12	yes	yes	no	no	panel	green, red	white	steel	14.0	ceiling, wall	yes	yes	1.5	5
USI Prescolite	Exit Lite	1	10.5	12.2	0.48	0.25	1.1	yes	lead calcium 6V	1.5	24	yes	yes	no	flash, flash and buzz (b)	stencil	green, red	aluminum, black, white	plastic	9.5	ceiling, pendant, wall	yes	yes	3	3 full + 3 prorata (d)
USI Prescolite	Exit Lite	2	18.0	21.4	0.48	0.25	1.1	no	N/A	N/A	N/A	N/A	N/A	N/A	no	stencil	green, red	aluminum, black, white	plastic	5.5	ceiling, pendant, wall	yes	yes	3	N/A
Electroluminescent																									
Dual Lite	Excalibur Electroluminescent	1	0.5	2.5	0.82	0.37	8.0	yes	lead acid 6V	1.5	24	yes	yes	yes	inc. lum., flash, flash and buzz	panel, stencil	green, red	aluminum, black, green, red, white	die cast aluminum	6.0	ceiling, pendant, wall	yes	yes	3	3 full + 3 prorata (d)
EMERGI-LITE	PRECEPTOR-Electroluminescent	1	1.0	1.0	0.95	0.95	8.0	yes	nickel cadmium 6V	1.5	12	yes	yes	no	inc. lum., flash, flash and buzz	stencil	green, red	aluminum, black, white	die cast aluminum	5.0	ceiling, pendant, recessed, wall	yes	yes	3	5 full + 7 prorata (d)
Lithonia Lighting	Signature Electroluminescent	1	0.6	0.8	0.46	0.27	5.7	yes	nickel cadmium 6V	1.5	24	yes	no	no	inc. lum., flash, flash and buzz	stencil	green, red	aluminum, black, bronze, white	die cast aluminum	5.0	ceiling, pendant, recessed, wall	yes	yes	3	3
USI Prescolite	Electroluminescent Exit Series	1	0.8	2.1	1.00	1.00	6.8	yes	nickel cadmium 6V	1.5	24	yes	yes	no	inc. lum., flash, flash and buzz	stencil	green, red	aluminum, black, white	die cast aluminum	5.0	ceiling, pendant, wall	yes	yes	5	5 full + 7 prorata (d)
Incandescent																									
Dual Lite	Excalibur Light Panel	24	13.0	13.8	0.93	0.96	20	yes	lead acid 4V	1.5	24	yes	yes	yes	flash, flash and buzz	panel, stencil	green, red, white	aluminum, black, green, red, white	die cast aluminum	6.0	ceiling, pendant, wall	yes	yes	3	3 full + 3 prorata (d)

N/A = not applicable

1 lb = 0.45 kg

Notes

(a) All signs use the same lamp for operating under both utility power and emergency power systems unless otherwise noted. The expression “inc. lum.” indicates increased sign luminance under emergency conditions; “no” indicates that the sign does not have any of the emergency options described in the “Data Tables” section on p. 15.

(b) This sign uses an incandescent lamp as an emergency light source.

(c) This sign uses a linear T5 fluorescent lamp.

(d) Warranty is prorated based on how many years of the warranty have elapsed.

Table 1 (continued). Manufacturer-Supplied Information: Exit Signs (listed by type of light source)

Manufacturer	Trade Name	Number of Light Sources	Rated Active Power (W) at		Power Factor at		Rated Lamp Life (yrs)	Battery Mode	Battery Type	Battery Operating Time (hrs)	Battery Recharge Time (hrs)	Low Battery Voltage Disconnect	Brown-out Circuitry	Auto Discharge/ Recharge Cycle	Emergency Options (a)	Sign Format	Available Color(s) of Letters	Available Color(s) of Background	Housing Material	Weight (lbs)	Mounting	Impact Resistant	Tamper Resistant	Warranty Period (yrs)	Warranty on Internal Battery (yrs)
			120V	277V	120V	277V																			
LED (Diffuser)																									
Dual Lite	Excalibur LED	144	7.0	7.0	0.90	0.90	20	yes	nickel cadmium 6V	1.5	24	no	yes	yes	inc. lum., flash, flash and buzz	stencil	green, red	aluminum, black, white	die cast aluminum	6.0	ceiling, pendant, wall	yes	yes	5	5 full + 3 prorata (d)
Lithonia Lighting	Signature-LE Series (e)	192	6.5	8.1	0.45	0.23	25	yes	nickel cadmium 6V	1.5	24	yes	no	no	inc. lum., flash, flash and buzz	stencil	green, red	aluminum, black, bronze, white	die cast aluminum	5.0	ceiling, pendant, recessed, wall	yes	yes	5	5
Teron Lighting Corp.	ULTRA LED	67	7.0	7.0	0.74	0.74	30	yes	nickel cadmium 6V	4.0	12	yes	yes	yes	flash	matrix	red	white	plastic (polycarbonate)	2.3	ceiling, pendant, wall	yes	yes	8	8
Teron Lighting Corp.	ULTRA LED	132	9.7	9.7	0.74	0.74	30	no	N/A	N/A	N/A	N/A	N/A	N/A	N/A	matrix	red	white	plastic (polycarbonate)	2.3	ceiling, pendant, wall	yes	yes	8	N/A
TLS mfg., inc.	STDX	72	2.5	2.5	0.50	0.40	100	yes	nickel cadmium 12V	5.0	12	no	yes	no	flash, flash and buzz	matrix	green, red	black, bronze, white	die cast aluminum	4.3	ceiling, wall	yes	no	20	7 prorata (d)
LED (Prismatic Diffuser)																									
EMERGI-LITE	PRECEPTOR L.E.D.	72	5.0	5.0	0.95	0.95	20	yes	nickel cadmium 6V	1.5	12	yes	yes	no	flash, flash and buzz	matrix	green, red	aluminum, black, white	die cast aluminum	5.5	ceiling, pendant, recessed, wall	yes	yes	5	5 full + 7 prorata (d)
Trace Lite Corporation	SlimLite	122	1.4	2.7	0.80	0.75	100	no	N/A	N/A	N/A	N/A	N/A	N/A	no	matrix, stencil	green, red, yellow (f)	aluminum, black, white	thermo plastic	2.0	ceiling, pendant, recessed, wall	yes	yes	20	N/A
LED (No Diffuser)																									
Computer Power Inc.	Illuminator-XD	127	5.0	5.0	0.80	0.80	100	yes	nickel cadmium 6V	2.0 (g)	16	no	yes	no	flash, flash and buzz (h)	matrix	green, red, green and red (i)	aluminum, black, white	die cast aluminum	7.0	ceiling, wall	yes	yes	20	5 prorata (d)
TLS mfg., inc.	LES EXIT	92	2.5	2.5	0.35	0.15	100	yes	lead calcium 6V	4.0	12	no	no	no	flash, flash and buzz	matrix	green, red	black, white	fiberglass flat panel	0.5	ceiling, wall	no	no	5	1
Trace Lite Corporation	Executive Series	122	5.3	4.7	0.92	0.73	100	yes	lead calcium 12V	4.0	8	yes	yes	yes	flash, flash and buzz	matrix	green, red, yellow (f)	black, green, white	thermo plastic, steel	5.0	ceiling, pendant, recessed, wall	yes	yes	20	5
Radioluminescent																									
EMERGI-LITE	EverLite	12	0.0	0.0	N/A	N/A	10/20 (j)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	no	stencil	green (k)	green, red	plastic (polycarbonate)	3.0	ceiling, pendant, wall	yes	yes	10/20 (l)	N/A
SPL, Inc.	EVERGLO	4 to 7 (m)	0.0	0.0	N/A	N/A	10/12 (j)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	no	stencil	green (k)	black, green, red	aluminum, plastic	3 to 5	ceiling, pendant, recessed, wall	yes	yes	10/12 (l)	N/A
SPL, Inc.	Omni-Glo	4 to 10 (m)	0.0	0.0	N/A	N/A	10/12/15/20 (j)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	no	stencil	green (k)	black, green, red	plastic	3 to 5	ceiling, pendant, recessed, wall	yes	yes	10/12/ 15/20 (l)	N/A
SRB Technologies	Betalux-E	15	0.0	0.0	N/A	N/A	10/15/20 (j)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	no	stencil	green (k)	black, green, red	plastic (polycarbonate)	1 to 2	ceiling, pendant, recessed, wall	yes	yes	10/15/20 (l)	N/A

N/A = not applicable

1 lb = 0.45 kg

Notes

(a) All signs use the same lamp for operating under both utility power and emergency power unless otherwise noted. The expression “inc. lum.” indicates increased sign luminance under emergency conditions; “no” indicates that the sign does not have any of the emergency options described in the “Data Tables” section on p. 15.

(b) This sign uses an incandescent lamp as an emergency light source.

(c) This sign uses a linear T5 fluorescent lamp.

(d) Warranty is prorated based on how many years of the warranty have elapsed.

(e) The individual LEDs are readily visible in this sign.

(f) The LEDs are set within the colored letters

(g) A range of battery operating times are available.

(h) This sign offers a digitized voice option.

(i) This sign is green during normal operation and red during utility power failure and/or fire alarm.

(j) Desired lamp life is specified at time of purchase.

(k) In the presence of room lighting, the letters appear white.

(l) Length of warranty is specified at time of purchase.

(m) The number of tubes depends on the actual sign that is selected.

Table 2. Manufacturer-Supplied Information: Retrofit Kits (listed by type of retrofit light source)

Manufacturer	Trade Name	Number of Light Sources per Sign	Color(s) of Light Source	Available Voltages	Rated Active Power (W) at		Power Factor at 120V	Rated Lamp Life (yrs)	Weight of Kit (oz)	Method of Connection (a)	Width (in)	Height (in)	Depth (in)	UL 924 Status	Warranty Period (yrs)
					120V	277V									
Host Sign															
Lithonia Lighting	Quantum	2	white	120/277	24.0	26.0	0.95	2.2	N/A	N/A	N/A	N/A	N/A	listed	3
Compact Fluorescent															
Brownlee Lighting	Fluorescent Exit Converter	1	white	120/277	10.5	10.5	0.50	0.85	8 (120V); 9 (277V)	screw-in, rewire	9.38	3.00	1.13	listed	2
Brownlee Lighting	PL Exit Converter	2 (b)	white	120/277	13.0	13.0	0.50	1.1	11 (120V); 12 (277V)	screw-in, rewire	9.00	5.75	1.13	listed	2
Brownlee Lighting	PL Exit Converter	1	white	120/277	13.0	13.0	0.50	1.1	8 (120V); 9 (277V)	screw-in, rewire	7.25	5.75	1.13	listed	2
Brownlee Lighting	PL Exit Converter	2	white	120/277	22.0	20.0	0.50	1.1	15 (120V); 17 (277V)	screw-in, rewire	10.75	4.75	1.13	listed	2
ENERSAVE Co.	Pow-R-Saver (c)	1	white	120/277	7.0	7.0	0.50	0.85	24	screw-in, rewire	9.50	3.75	1.00	listed	1
ENERSAVE Co.	Pow-R-Saver	1	white	120/277	11.0	11.0	0.50	1.1	16	screw-in, rewire	7.50	3.50	1.25	listed	1
ENERSAVE Co.	Pow-R-Saver (c)	2 (b)	white	120/277	7.0	7.0	0.50	0.85	24	screw-in, rewire	9.50	4.00	1.00	listed	1
ENERSAVE Co.	Pow-R-Saver	2 (b)	white	120/277	11.0	11.0	0.50	1.1	24	screw-in, rewire	9.50	4.75	1.25	listed	1
Hetherington Industries, Inc.	Series 107	2	white	120	16.0	N/V	0.55	0.85	16	screw-in, rewire	10.00	7.00	1.00	not tested	1
INCON INDUSTRIES INC.	INCON	1	white	120/277	9.0	9.0	0.45	1.1	12	screw-in, rewire	5.75	2.25	1.13	listed	2
JANMAR Lighting	Series 230	2	white	120	15.6	N/V	0.47	1.1	7 (no lamp)	screw-in, rewire	6.00	5.50	1.13	listed	3
JANMAR Lighting	Series 230	2	white	120	17.6	N/V	0.57	1.1	7 (no lamp)	screw-in, rewire	6.00	5.50	1.13	listed	3
JANMAR Lighting	Series 230	1	white	120	10.0	N/V	0.65	1.1	7 (no lamp)	screw-in, rewire	7.50	5.00	1.13	listed	3
Mule Emergency Lighting, Inc.	Retro-X	1	white	120/277	9.0	9.0	0.50	1.1	16	screw-in, rewire	7.50	7.00	1.50	listed	1
ProLight	ProLight	1	white	120	11.0	N/V	0.62	1.1	16	screw-in, rewire	10.00	6.50	1.50	listed	3
ProLight	ProLight	2 (b)	white	120	11.0	N/V	0.62	1.1	16	screw-in, rewire	10.00	6.50	1.50	listed	3
ProLight	ProLight	2	white	120	12.0	N/V	0.58	1.1	16	screw-in, rewire	10.00	6.00	1.50	listed	3
OSRAM SYLVANIA INC.	EX120/9TT	1	white	120	11.0	N/V	0.55	1.1	11	screw-in	11.00	7.00	1.50	listed	1
Teron Lighting Corp.	Tee Shot	2 (b)	white	120/277	12.0	12.0	0.58	1.1	16	screw-in, rewire	9.25	3.38	1.13	listed	1
Teron Lighting Corp.	Tee Shot	1	white	120/277	12.0	12.0	0.58	1.1	16	screw-in, rewire	9.25	3.38	1.13	listed	1
Electroluminescent															
Loctite Luminescent Systems, Inc.	E.R.K.ONIMIZER	1	green	120	< 1	N/V	0.28	10	< 4	rewire	10.00	6.25	0.25	classified	5
Incandescent															
Flexlite, Inc.	Exlite	20	white	120/277	8.1	11.2	0.99	5.2	3	screw-in	(d)	N/A	N/A	classified	3
Martek Industries, Inc.	Permalite	2	white	120	9.0	N/V	1.00	17	3	screw-in	(e)	N/A	N/A	not tested	10
Standard Enterprises, Inc.	EternaLamp	2	white	120/277	18.0	18.0	1.00	15	2	screw-in	(e)	N/A	N/A	tested (f)	3
Teron Lighting Corp.	FLEX	20	white	120/277	10.0	12.0	1.00	3.4	8	screw-in, rewire	(d)	N/A	N/A	tested (f)	1
LED															
Computer Power Inc.	AstraLite	32	red	120/277	1.8	1.8	0.40	100	8	screw-in	6 to 14	6.00	0.50	listed	25
Energy-Wise Lighting, Inc.(g)	Retro-Ex.87 Universal	64	green, red	120	0.9	N/V	0.10	20	16	screw-in	10.00	7.00	N/A	listed	10
Teron Lighting Corp. (g)	ULTRA Retrofit	132	green, red	120/277	9.7	9.7	0.74	30	35	screw-in, rewire	11.88	7.38	N/A	tested (f)	8

N/A = not applicable
N/V = not available
1 in = 2.54 cm
1 oz = 28 gm

Notes

(a) Retrofit kits that use a rewire connection cannot be UL listed. Thus the UL 924 listed status shown only applies to the screw-in connections.

(b) This retrofit kit contains two lamps, but only one operates at a time.

(c) This kit uses a linear T5 fluorescent lamp.

(d) This kit is 0.5 inches in diameter by 20 inches long.

(e) Each lamp is 5 inches long.

(f) This retrofit kit has been tested by ETL Testing Laboratories, Inc. to the applicable requirements of UL 924.

(g) This retrofit kit consists of a replacement face plate.

Table 3. NLPIP-Measured Data: Exit Signs (listed by type of light source)

Manufacturer	Trade Name	Catalog No.	Sign Format	Letter Color	Background Color	Regulated Power Supply					Battery-Operated					Active Power (W) at 120V (a)	Power Factor at 120V	Apparent Power (rms VA) at 120V	Readability (Out of 14, the Number of Subjects Unable to Identify Letter Orientation at Each Distance)			
						Mean Letter Luminance (cd/m^2)	Letter Luminance Range (cd/m^2)	Mean Background Luminance (cd/m^2)	Background Luminance Range (cd/m^2)	Luminance Contrast	Mean Letter Luminance (cd/m^2)	Letter Luminance Range (cd/m^2)	Mean Background Luminance (cd/m^2)	Background Luminance Range (cd/m^2)	Luminance Contrast				Lights Off		Lights On	
																			100 ft	150 ft	100 ft	150 ft
Circline Fluorescent																						
Beghelli Inc.	Pratica Bella Exit	8320-SA2PX/US	panel	white	green	2400	590 – 4400	400	160 – 760	0.83	1500	350 – 2500	260	94 – 420	0.83	21	0.67	31	2	8	2	8
Compact Fluorescent																						
Hetherington Industries, Inc.	Series 132	132-(2)PL7-SF	stencil	red	aluminum	310	31 – 1200	6.9	2.2 – 20	0.98	N/A	N/A	N/A	N/A	N/A	18	0.52	35	0	2	0	4
INCON INDUSTRIES INC.	INCON	EX 100	stencil	red	white	270	23 – 1100	12	6.5 – 26	0.96	N/A	N/A	N/A	N/A	N/A	11	0.54	20	1	2	0	1
KENALL	TRAILMATE	6501-T	panel	red	white	140	25 – 280	700	80 – 1800	0.80	N/A	N/A	N/A	N/A	N/A	14	0.42	33	0	5	0	3
Lithonia Lighting	Titan Fluorescent	F2XS1R 120	stencil	red	black	420	210 – 1300	10	2.8 – 27	0.98	N/A	N/A	N/A	N/A	N/A	20	0.43	47	0	1	0	0
Radiant Illumination Inc.	NXL “Excellence” (b)	ENXL-R	stencil	red	black	220	110 – 470	6.6	3.0 – 13	0.97	130	55 – 270	4.0	1.9 – 7.0	0.97	29	0.57	51	0	2	0	1
Radiant Illumination Inc.	VX “Vandal Proof” (b)	EVX-RA	panel	red	white	51	19 – 110	520	160 – 1200	0.90	21	8.7 – 46	210	64 – 530	0.90	25	0.50	50	0	4	0	3
USI Prescolite	Exit Lite	EX3PL1-REMFA	stencil	red	white	110	20 – 880	4.4	2.3 – 11	0.96	35	6.1 – 220	2.9	1.7 – 4.0	0.92	10	0.55	19	0	4	1	5
USI Prescolite	Exit Lite	EX3PL2-R	stencil	red	white	120	17 – 530	4.8	2.6 – 10	0.96	N/A	N/A	N/A	N/A	N/A	14	0.39	36	0	6	5	9
Electroluminescent																						
Dual Lite	Excalibur Electroluminescent	CWGBB-I-LME	stencil	green	black	12	10 – 13	0.27	0.13 – 0.61	0.98	61	53 – 73	1.7	0.58 – 3.4	0.97	4.3	0.76	5.7	0	4	0	6
EMERGI-LITE	PRECEPTOR-Electroluminescent-master	ELPXN1R	stencil	red	aluminum	3.5	3.2 – 3.7	0.08	0.05 – 0.12	0.98	20	18 – 22	0.42	0.26 – 0.68	0.98	3.2	0.48	6.7	0	2	5	10
EMERGI-LITE	PRECEPTOR-Electroluminescent-slave	ELP1R-LL	stencil	red	aluminum	2.9	2.7 – 3.1	0.08	0.05 – 0.10	0.97	11	10 – 12	0.23	0.14 – 0.49	0.98	N/T	N/T	N/T	N/T	N/T	N/T	N/T
EMERGI-LITE	PRECEPTOR-Electroluminescent-master with slave attached		stencil	red	aluminum	3.5	3.1 – 3.7	0.08	0.04 – 0.12	0.98	13	12 – 14	0.26	0.15 – 0.79	0.98	N/T	N/T	N/T	N/T	N/T	N/T	N/T
Lithonia Lighting	Signature Electroluminescent	ELES 1R120	stencil	red	aluminum	2.2	1.7 – 2.3	0.05	0.03 – 0.10	0.98	N/A	N/A	N/A	N/A	N/A	0.40	0.38	1.1	0	1	3	7
USI Prescolite	Electroluminescent Exit Series	EL1516	stencil	red	white	2.8	2.5 – 2.9	0.07	0.03 – 0.21	0.98	N/A	N/A	N/A	N/A	N/A	0.40	0.36	1.1	0	1	0	4
USI Prescolite	Electroluminescent Exit Series	EL1216-EN	stencil	red	white	1.5	1.2 – 1.7	0.11	0.07 – 0.14	0.93	7.6	5.9 – 9.3	0.24	0.15 – 0.45	0.97	3.6	0.82	4.4	0	1	1	5
Incandescent																						
Dual Lite	Excalibur Light Panel	CWRNB-I-LP	stencil	red	aluminum	15	9.4 – 27	0.95	0.75 – 1.3	0.94	N/A	N/A	N/A	N/A	N/A	13	0.95	14	0	3	2	8
LED (Diffuser)																						
Dual Lite	Excalibur LED	CSGBB-LED	stencil	green	black	25	20 – 33	0.88	0.64 – 2.0	0.96	N/A	N/A	N/A	N/A	N/A	8.0	0.85	9.4	0	4	0	3
Lithonia Lighting	Signature LE Series	LES 1R120/277	matrix	red	aluminum	38	18 – 53	3.8	3.0 – 5.7	0.90	N/A	N/A	N/A	N/A	N/A	6.0	0.41	15	0	1	0	3
Teron Lighting Corp.	ULTRA LED	U12SN-SF-NA	stencil	red	white	43	25 – 58	0.56	0.27 – 0.85	0.99	N/A	N/A	N/A	N/A	N/A	9.2	0.57	16	0	1	1	6
TLS mfg., inc.	STDX	STDX-1X-R/A-BP	matrix	red	aluminum	24	16 – 33	0.60	0.47 – 0.88	0.97	33	24 – 43	0.57	0.33 – 1.2	0.98	2.9	0.26	11	0	2	0	8
LED (Prismatic Diffuser)																						
EMERGI-LITE	PRECEPTOR L.E.D.	LEDPXN1RCM	stencil	red	aluminum	43	28 – 71	1.3	0.89 – 2.1	0.97	32	20 – 63	1.1	0.83 – 1.9	0.96	8.0	0.66	12	0	2	0	0
Trace Lite Corporation	SlimLite	1TRKND1	stencil	red	black	29	19 – 47	0.59	0.23 – 1.5	0.98	N/A	N/A	N/A	N/A	N/A	2.3	0.92	2.5	0	1	0	0
LED (No Diffuser)																						
Computer Power Inc.	Illuminator-XD	XDNSP1RASVAA	matrix	red	aluminum	150	58 – 230	6.2	3.7 – 9.3	0.96	140	75 – 230	6.5	5.0 – 8.9	0.96	8.0	0.87	9.2	0	2	0	0
TLS mfg., inc.	LES EXIT	LES-1X-R/W-120	matrix	red	white	63	32 – 97	1.4	0.78 – 1.7	0.98	N/A	N/A	N/A	N/A	N/A	2.4	0.28	8.6	0	1	0	0
Trace Lite Corporation	Executive Series	1RKNDB	matrix	red	white	100	63 – 150	2.8	2.1 – 4.3	0.97	100	57 – 150	2.7	1.9 – 4.0	0.97	4.8	0.93	5.2	0	1	0	4
Radioluminescent																						
EMERGI-LITE	EverLite	W-SLX-20-61-R	stencil	green (c)	green	0.41	0.23 – 0.48	0.00	0 – 0.03	1.00	N/A	N/A	N/A	N/A	N/A	0.00	N/A	N/A	4	11	0	9
SPL, Inc.	EVERGLO	710A	stencil	green (c)	red	0.34	0.19 – 0.47	0.00	0 – 0.01	1.00	N/A	N/A	N/A	N/A	N/A	0.00	N/A	N/A	7	13	5	12
SPL, Inc.	Omni-Glo	700C-1(10)	stencil	green (c)	red	0.26	0.19 – 0.29	0.00	0 – 0.01	1.00	N/A	N/A	N/A	N/A	N/A	0.00	N/A	N/A	9	13	0	5
SRB Technologies	Betalux-E	171-R-20	stencil	green (c)	red	0.35	0.28 – 0.47	0.00	0 – 0.02	1.00	N/A	N/A	N/A	N/A	N/A	0.00	N/A	N/A	5	13	1	9

N/A = not applicable

N/T = not tested

1 ft = 0.30 m

1 cd/m^2 = 0.29 fL

Notes

NLPIP measured data for one sample of each sign. All luminance and power measurements are rounded to two significant figures, except where this would exceed the measurement precision.

(a) The presence of a battery may increase the active power of a sign.

(b) This sign uses a linear T5 fluorescent lamp.

(c) In the presence of room lighting, the letters appear white.

Table 4. NLPIP-Measured Data: Retrofit Kits (listed by type of retrofit light source)

Manufacturer	Trade Name	Catalog No.	Mean Letter Luminance (cd/m^2)	Letter Luminance Range (cd/m^2)	Mean Background Luminance (cd/m^2)	Background Luminance Range (cd/m^2)	Luminance Contrast	Active Power (W) at 120V	Power Factor at 120V	Apparent Power (rms VA) at 120V	Readability (Out of 14, the Number of Subjects Unable to Identify Letter Orientation at Each Distance)			
											Lights Off		Lights On	
											100 ft	150 ft	100 ft	150 ft
Host Sign														
Lithonia Lighting	Quantum	QMSW3R120	110	44 – 210	3.9	1.1 – 27	0.96	23	1.0	23	0	3	0	2
Compact Fluorescent														
Brownlee Lighting	Fluorescent Exit Converter	3080-6	140	39 – 340	3.6	1.2 – 7.9	0.97	11	0.50	22	0	0	0	5
Brownlee Lighting	PL Exit Converter	3090-2x9 (a)	430	66 – 3200	13	3.7 – 57	0.97	12	0.58	21	1	5	0	6
Brownlee Lighting	PL Exit Converter	3150-9	400	65 – 1600	12	4.3 – 37	0.97	10	0.58	17	0	4	0	2
Brownlee Lighting	PL Exit Converter	3170-2x5	390	120 – 1500	15	8.4 – 33	0.96	17	0.45	38	0	2	0	2
ENERSAVE Co.	Pow-R-Saver (b)	PSE/SC	140	30 – 520	3.9	2.0 – 9.7	0.97	8.9	0.46	19	0	1	0	4
ENERSAVE Co.	Pow-R-Saver	PSE/TT/SC	440	48 – 2100	11	4.4 – 36	0.97	10	0.55	18	0	2	0	2
ENERSAVE Co.	Pow-R-Saver (b)	PSE/2F/SC (a)	170	23 – 650	5.0	2.2 – 13	0.97	9.5	0.45	21	0	1	1	4
ENERSAVE Co.	Pow-R-Saver	PSE/2TT/SC (a)	440	98 – 1200	17	5.2 – 52	0.96	10	0.58	17	0	4	0	5
Hetherington Industries, Inc.	Series 107	107-012D-504	270	43 – 870	6.7	1.7 – 20	0.98	19	0.48	40	0	4	2	4
INCON INDUSTRIES INC.	INCON	ER 64	260	23 – 1700	8.0	2.9 – 29	0.97	11	0.48	23	0	1	0	1
JANMAR Lighting	Series 230	230-5-L	420	56 – 1200	14	5.0 – 48	0.97	15	0.43	35	0	3	0	1
JANMAR Lighting	Series 230	230-7-L	590	79 – 1800	27	9.0 – 76	0.95	17	0.48	35	0	4	0	1
JANMAR Lighting	Series 230	230-9-L	420	97 – 1700	22	11 – 67	0.95	9.3	0.58	16	0 (c)	3 (c)	0	2
Mule Emergency Lighting, Inc.	Retro-X	963020	330	51 – 1900	9.5	2.6 – 37	0.97	8.9	0.56	16	0	5	0	4
ProLight	ProLight	EMX1-SIC	520	49 – 2900	14	6.5 – 37	0.97	11	0.53	21	0	1	0	1
ProLight	ProLight	EMX21-SIC (a)	220	47 – 1600	8.6	4.8 – 23	0.96	11	0.55	20	0	4	1	3
ProLight	ProLight	EMX22-SIC	290	64 – 1500	11	5.7 – 24	0.96	16	0.41	39	1	1	0	0
OSRAM SYLVANIA INC.	EX120/9TT	29094	490	110 – 2100	14	4.3 – 44	0.97	11	0.58	19	0	4	0	1
Teron Lighting Corp.	Tee Shot	TL9-FF-SC (a)	400	110 – 1200	15	3.0 – 54	0.96	9.5	0.53	18	0	2	0	4
Teron Lighting Corp.	Tee Shot	TL9-SC	450	41 – 2700	11	3.5 – 44	0.98	8.9	0.58	15	0	5	0	5
Electroluminescent														
Loctite Luminescent Systems	E.R.K.ONOMIZER (d)	6983-1	21	20 – 23	0.59	0.22 – 1.2	0.97	0.39	0.27	1.4	1	3	11	13
Incandescent														
Flexlite, Inc.	Exlite	FL 120-C	36	16 – 65	0.84	0.30 – 1.8	0.98	8.4	1.0	8.4	0	2	3	9
Martek Industries Inc.	Permalite	PML	23	8.6 - 53	0.92	0.53 – 1.7	0.96	9.7	1.0	9.7	0	0	2	5
Standard Enterprises, Inc.	EternaLamp	ETS/120	33	12 – 73	1.9	1.4 – 2.5	0.94	17	1.0	17	0	4	0	6
Teron Lighting Corp.	FLEX	FT10-C	26	5.3 – 64	0.69	0.30 – 2.0	0.97	7.8	1.0	7.8	0	4	4	7
LED														
Computer Power Inc.	AstraLite	RETRO-I1R6AAA	25	16 – 34	1.2	0.87 – 1.9	0.95	1.6	0.16	10	0	3	1	4
Energy-Wise Lighting, Inc.	Retro-Ex.87 Universal (e)	Retro-Ex.87 Univ	460	290 – 630	8.4	3.2 – 18	0.98	0.84	0.10	8.4	0	2	0	1
Teron Lighting Corp.	ULTRA Retrofit (e)	U12R-SF-NA	47	27 – 72	0.78	0.51 – 1.1	0.98	9.4	0.57	16	0	1	1	6

1 ft = 0.30 m

1 cd/m^2 = 0.29 fL

Notes

NLPIP measured data for one sample of each retrofit kit. All luminance and power measurements are rounded to two significant figures.

(a) This retrofit kit contains two lamps, but only one operates at a time.

(b) This kit uses a linear T5 fluorescent lamp.

(c) Data are from 13 subjects only.

(d) This retrofit kit did not use the red filter of the host sign because the retrofit kit emits green light.

(e) This retrofit kit was not installed within the host sign because it consists of a replacement faceplate; it was evaluated as submitted.

Table 5. Calculated Data: Visibility in Smoke for Exit Signs (listed by type of light source)

Manufacturer	Trade Name	Catalog No.	Sign Type	Letter Color	Background Color	Clear-Air Conditions: Regulated Power Supply: Mean Letter Luminance (cd/m^2)	Clear-Air Conditions: Regulated Power Supply: Mean Background Luminance (cd/m^2)	Clear-Air Conditions: Regulated Power Supply: Luminance Contrast	Clear-Air Conditions: Battery-Operated: Mean Letter Luminance (cd/m^2)	Clear-Air Conditions: Battery-Operated: Mean Background Luminance (cd/m^2)	Clear-Air Conditions: Battery-Operated: Luminance Contrast	Smoke Simulations: Regulated Power Supply: Mean Letter Luminance at 16 ft (cd/m^2)	Smoke Simulations: Regulated Power Supply: Mean Background Luminance at 16 ft (cd/m^2)	Smoke Simulations: Regulated Power Supply: Luminance Contrast at 16 ft	Smoke Simulations: Regulated Power Supply: Critical Distance (ft)	Smoke Simulations: Battery-Operated: Mean Letter Luminance at 16 ft (cd/m^2)	Smoke Simulations: Battery-Operated: Mean Background Luminance at 16 ft (cd/m^2)	Smoke Simulations: Battery-Operated: Luminance Contrast at 16 ft	Smoke Simulations: Battery-Operated: Critical Distance (ft)
Circline Fluorescent																			
Beghelli Inc.	Pratica Bella Exit	8320-SA2PX/US	panel	white	green	2400	400	0.83	1500	260	0.83	75	35	0.53	41	47	23	0.52	40
Compact Fluorescent																			
Hetherington Industries, Inc.	Series 132	132-(2)PL7-SF	stencil	red	aluminum	310	6.9	0.98	N/A	N/A	N/A	9.5	3.3	0.66	35	N/A	N/A	N/A	N/A
INCON INDUSTRIES INC.	INCON	EX 100	stencil	red	white	270	12	0.96	N/A	N/A	N/A	8.6	3.3	0.62	35	N/A	N/A	N/A	N/A
KENALL	TRAILMATE	6501-T	panel	red	white	140	700	0.80	N/A	N/A	N/A	20	27	0.28	40	N/A	N/A	N/A	N/A
Lithonia Lighting	Titan Fluorescent	F2XS1R 120	stencil	red	black	420	10	0.98	N/A	N/A	N/A	13	4.3	0.67	36	N/A	N/A	N/A	N/A
Radiant Illumination Inc.	NXL "Excellence" (a)	E-NXL-R	stencil	red	black	220	6.6	0.97	130	4.0	0.97	6.9	2.3	0.66	34	3.9	1.3	0.66	31
Radiant Illumination Inc.	VX “Vandal Proof” (a)	EVX-RA	panel	red	white	51	520	0.90	21	210	0.90	10	18	0.42	38	4.3	7.3	0.41	35
USI Prescolite	Exit Lite	EX3PL1-REMFA	stencil	red	white	110	4.4	0.96	35	2.9	0.92	3.6	1.2	0.67	31	1.1	0.42	0.63	25
USI Prescolite	Exit Lite	EX3PL2-R	stencil	red	white	120	4.8	0.96	N/A	N/A	N/A	4.0	1.5	0.62	32	N/A	N/A	N/A	N/A
Electroluminescent																			
Dual Lite	Excalibur Electroluminescent	CWGBB-I-LME	stencil	green	black	12	0.27	0.98	61	1.7	0.97	0.31	0.05	0.84	19	1.8	0.56	0.69	28
EMERGI-LITE	PRECEPTOR-Electroluminescent-master	ELPXN1R	stencil	red	aluminum	3.5	0.08	0.98	20	0.42	0.98	0.0	0.0	—	14	0.59	0.16	0.73	21
EMERGI-LITE	PRECEPTOR-Electroluminescent-slave	ELP1R-LL	stencil	red	aluminum	2.9	0.08	0.97	11	0.23	0.98	0.0	0.0	—	14	0.30	0.04	0.87	18
EMERGI-LITE	PRECEPTOR-Electroluminescent-master with slave attached		stencil	red	aluminum	3.5	0.08	0.98	13	0.26	0.98	0.0	0.0	—	14	0.30	0.05	0.84	18
Lithonia Lighting	Signature Electroluminescent	ELES 1R120	stencil	red	aluminum	2.2	0.05	0.98	N/A	N/A	N/A	0.0	0.0	—	13	N/A	N/A	N/A	N/A
USI Prescolite	Electroluminescent Exit Series	EL1516	stencil	red	white	2.8	0.07	0.98	N/A	N/A	N/A	0.0	0.0	—	13	N/A	N/A	N/A	N/A
USI Prescolite	Electroluminescent Exit Series	EL1216-EN	stencil	red	aluminum	1.5	0.11	0.93	7.6	0.24	0.97	0.0	0.0	—	11	0.29	0.0	1.0	18
Incandescent																			
Dual Lite	Excalibur Light Panel	CWRNB-I-LP	stencil	red	aluminum	15	0.95	0.94	N/A	N/A	N/A	0.46	0.15	0.67	21	N/A	N/A	N/A	N/A
LED (Diffuser)																			
Dual Lite	Excalibur LED	CSGBB-LED	stencil	green	black	25	0.88	0.96	N/A	N/A	N/A	0.63	0.13	0.79	22	N/A	N/A	N/A	N/A
Lithonia Lighting	Signature LE Series	LES 1R120/277	matrix	red	aluminum	38	3.8	0.90	N/A	N/A	N/A	1.1	0.39	0.64	26	N/A	N/A	N/A	N/A
Teron Lighting Corp.	ULTRA LED	U12SN-SF-NA	stencil	red	white	43	0.56	0.99	N/A	N/A	N/A	1.0	0.24	0.77	23	N/A	N/A	N/A	N/A
TLS mfg., inc.	STDX	STDX-1X-R/A-BP	matrix	red	aluminum	24	0.60	0.97	33	0.57	0.98	0.62	0.14	0.78	22	0.85	0.23	0.73	23
LED (Prismatic Diffuser)																			
EMERGI-LITE	PRECEPTOR L.E.D.	LEDPXN1RCM	stencil	red	aluminum	43	1.3	0.97	32	1.1	0.96	1.1	0.30	0.73	25	0.85	0.27	0.68	23
Trace Lite Corporation	SlimLite	1TRKND1	stencil	red	black	29	0.59	0.98	N/A	N/A	N/A	0.81	0.26	0.69	23	N/A	N/A	N/A	N/A
LED (No Diffuser)																			
Computer Power Inc.	Illuminator-XD	XDNSP1RASVAA	matrix	red	aluminum	150	6.2	0.96	140	6.5	0.96	3.8	1.0	0.73	31	3.6	0.91	0.74	31
TLS mfg., inc.	LES EXIT	LES-1X R/W-120	matrix	red	white	63	1.4	0.98	N/A	N/A	N/A	1.6	0.36	0.77	27	N/A	N/A	N/A	N/A
Trace Lite Corporation	Executive Series	1RKNDB	matrix	red	white	100	2.8	0.97	100	2.7	0.97	2.5	0.65	0.75	30	2.5	0.60	0.76	30

N/A = not applicable
1 ft = 0.30 m
1 cd/m^2 = 0.29 fL

Notes

Calculated smoke simulation values are based on measurements in clear-air conditions.

All luminance measurements are rounded to two significant figures, except where this would exceed the measurement precision.

Luminance contrast was not calculated where either mean letter luminance or mean background luminance was 0.00.

(a) This sign uses a linear T5 fluorescent lamp.

Table 6. Calculated Data: Visibility in Smoke for Retrofit Kits (listed by type of retrofit light source)

Manufacturer	Trade Name	Catalog No.	Clear-Air Conditions			Smoke Simulations			
			Mean Letter Luminance (cd/m^2)	Mean Background Luminance (cd/m^2)	Luminance Contrast	Mean Letter Luminance at 16 ft (cd/m^2)	Mean Background Luminance at 16 ft (cd/m^2)	Luminance Contrast at 16 ft	Critical Distance (ft)
Host Sign									
Lithonia Lighting	Quantum	QMSW3R120	110	3.9	0.96	3.4	1.2	0.64	31
Compact Fluorescent									
Brownlee Lighting	Fluorescent Exit Converter	3080-6	140	3.6	0.97	4.6	1.6	0.65	32
Brownlee Lighting	PL Exit Converter	3090-2x9 (a)	430	13	0.97	14	5.3	0.63	37
Brownlee Lighting	PL Exit Converter	3150-9	400	12	0.97	13	5.0	0.63	37
Brownlee Lighting	PL Exit Converter	3170-2x5	390	15	0.96	12	3.8	0.68	36
ENERSAVE Co.	Pow-R-Saver (b)	PSE/SC	140	3.9	0.97	4.2	1.4	0.68	31
ENERSAVE Co.	Pow-R-Saver	PSE/TT/SC	440	11	0.97	14	4.8	0.66	37
ENERSAVE Co.	Pow-R-Saver (b)	PSE/2F/SC167 (a)	170	5.0	0.97	5.0	1.6	0.69	32
ENERSAVE Co.	Pow-R-Saver	PSE/2TT/SC (a)	440	17	0.96	15	6.1	0.59	38
Hetherington Industries, Inc.	Series 107	107-012D-504	270	6.7	0.98	8.7	3.0	0.66	35
INCON INDUSTRIES INC.	INCON	ER 64	260	8.0	0.97	9.2	3.7	0.60	36
JANMAR Lighting	Series 230	230-5-L	420	14	0.97	13	5.0	0.63	37
JANMAR Lighting	Series 230	230-7-L	590	27	0.95	19	7.5	0.61	38
JANMAR Lighting	Series 230	230-9-L	420	22	0.95	14	5.3	0.61	37
Mule Emergency Lighting, Inc.	Retro-X	963020	330	9.5	0.97	11	4.4	0.60	36
ProLight	ProLight	EMX1-SIC	520	14	0.97	16	4.7	0.70	37
ProLight	ProLight	EMX21-SIC (a)	220	8.6	0.96	7.0	2.5	0.64	35
ProLight	ProLight	EMX22-SIC	290	11	0.96	9.4	3.4	0.64	36
OSRAM SYLVANIA INC.	EX120/9TT	29094	490	14	0.97	16	5.6	0.65	37
Teron Lighting Corp.	Tee Shot	TL9-FF-SC (a)	400	15	0.96	14	6.4	0.56	37
Teron Lighting Corp.	Tee Shot	TL9-SC	450	11	0.98	14	4.7	0.67	37
Electroluminescent									
Loctite Luminescent Systems	E.R.K.ONOMIZER (c)	6983-1	21	0.59	0.97	0.60	0.21	0.65	22
Incandescent									
Flexlite, Inc.	Exlite	FL 120-C	36	0.84	0.98	1.1	0.37	0.67	26
Martek Industries Inc.	Permalite	PML	23	0.92	0.96	0.69	0.25	0.64	22
Standard Enterprises, Inc.	EternaLamp	ETS/120	33	1.9	0.94	1.0	0.41	0.59	25
Teron Lighting Corp.	FLEX	FT10-C	26	0.69	0.97	0.70	0.27	0.62	23
LED									
Computer Power Inc.	AstraLite	RETRO-I1R6AAA	25	1.2	0.95	0.75	0.33	0.56	25
Energy-Wise Lighting, Inc.	Retro-Ex.87 Universal (d)	Retro-Ex.87 Univ	460	8.4	0.98	11	1.9	0.82	33
Teron Lighting Corp.	ULTRA Retrofit (d)	U12R-SF-NA	47	0.78	0.98	1.1	0.26	0.77	24

1 ft = 0.30 m

1 cd/m^2 = 0.29 fL

Notes

Calculated smoke simulation values are based on measurements in clear-air conditions. All luminance measurements are rounded to two significant figures, except where this would exceed the measurement precision.

(a) This retrofit kit contains two lamps, but only one operates at a time.

(b) This retrofit kit uses a linear T5 fluorescent lamp.

(c) This retrofit kit did not use the red filter of the host sign because the retrofit kit emits green light.

(d) This retrofit kit was not installed within the host sign because it consists of a replacement faceplate; it was evaluated as submitted.

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NATIONAL LIGHTING PRODUCT INFORMATION PROGRAM

Specifier Reports

Exit Signs

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Author: Peter Boyce
Principal Investigator: Robert Davis
Project Director: Russell Leslie
Editorial Review: Kathryn Conway
Amy Fowler
Mark Rea
Production: Catherine Luo
Photography: Donna Abbott Vlahos

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This publication is a supplement to *Specifier Reports: Exit Signs*, published in January 1994. It contains information on energy-efficient, single-faced exit signs and retrofit conversion kits that presently are on the market, but that the National Lighting Product Information Program (NLPIP) did not test in the original *Specifier Reports*, either because the manufacturer did not submit them or because they had not yet been introduced to the market. The tables in this supplement contain information supplied by the manufacturers of the products and the results of product tests conducted by NLPIP. Manufacturers that submitted product information and sample products to NLPIP by October 1, 1994, are included. NLPIP performed product testing from October to December 1994 at the Lighting Research Center's Niagara Mohawk Lighting Research Laboratory in Watervliet, New York.

The tables in this supplement contain data for the same performance characteristics that were presented in the original publication. To facilitate comparisons between products in this report and products in the earlier publication, the format and testing procedures are identical to those of the earlier publication, with one exception. For this supplement, exit signs were operated on a regulated power supply at 120 ±0.5 volts (V) ac, not 120 ±0.1 V ac; NLPIP believes that this difference in voltage tolerance is negligible.

Each retrofit kit was installed (according to the manufacturer's instructions) in the same brand and model host sign used in the earlier report. As in the earlier publication, all of the full exit signs in Table 1 conform to Underwriters Laboratories Standard 924 (Underwriters Laboratories 1991). The UL status of the retrofit kits is listed in Table 2.

A noteworthy addition in this supplement is the evaluation of three edge-lit exit signs. For edge-lit exit signs that have a clear (see-through) backing, the contrast of the sign letters to the surrounding material is affected by what is behind the sign. NLPIP therefore evaluated the performance of the edge-lit signs with the signs placed in front of a matte black background.

For information regarding the application of exit signs and retrofit kits and an explanation of the terms used in the tables, consult *Specifier Reports: Exit Signs.*

The production of this supplement involved important contributions from many staff members at the Lighting Research Center (LRC). A. Bierman and H. Liang conducted the photometric and power measurements; and B. Hamilton, M. Mizukami, K. Pero, R. Strobel, A. Wadhwa, and Y. Yoshida measured the readability of the exit signs. Other LRC project team members who contributed include N. Bayer, P. Boyce, J. Gross, K. Heslin, R. Leslie, and M. Rea.

Table 1. Manufacturer-Supplied Information: Exit Signs (listed by type of light source)

Manufacturer	Trade Name	Number of Light Sources	Rated Active Power (W) at		Power Factor at		Rated Lamp Life (yr)	Battery Mode	Battery Type	Battery Operating Time (h)	Battery Recharge Time (h)	Low Battery Voltage Disconnect
			120 V	277 V	120 V	277 V						
Compact Fluorescent												
Sure-Lites	ELX Series Fluorescent Edgelit Exit[b]	2	23.0	25.0	0.56	0.6	0.86	yes	nickel cadmium 6 V	1.5	<24	yes
Sure-Lites	Pinnacle Die Cast Exit	2	27.0	24.0	0.59	0.66	1.1	yes	lead calcium or nickel cadmium 6 V	1.5	<24	yes
Sure-Lites	Steel Compact Fluorescent Exit	2	15.0	23.0	0.39	0.30	1.1	yes	lead calcium or nickel cadmium 6 V	1.5 or 2	<24	yes
Incandescent												
Big Beam Emergency Systems, Inc.	DLWX	2	12.5	13.8	0.92	0.98	2.3	no	NA	NA	NA	NA
Big Beam Emergency Systems, Inc.	EDLWX	2	16.0	16.0	0.95	0.95	2.3	yes	nickel cadmium 4.8 V	1.5	24	yes
Big Beam Emergency Systems, Inc.	ELWX	2	16.0	16.0	0.95	0.95	2.3	yes	nickel cadmium 4.8 V	1.5	24	yes
Big Beam Emergency Systems, Inc.	LWX	2	12.5	13.8	0.92	0.98	2.3	no	NA	NA	NA	NA
LED (Diffuser)												
ALKCO	LED EDGE-GLO	24	NS	NS	NS	NS	11.4	yes	lead acid	2	24	NS
Big Beam Emergency Systems, Inc.	DXLS	24	1.7	1.7	0.24[e]	0.10	100	no	NA	NA	NA	NA
Big Beam Emergency Systems, Inc.	EDXLS	24	1.7	1.7	0.24[e]	0.10	100	yes	nickel cadmium 7.2 V	3	24	yes
Big Beam Emergency Systems, Inc.	EXFL	24	1.7	1.7	0.24[e]	0.10	100	yes	nickel cadmium 7.2 V	3	24	yes
Big Beam Emergency Systems, Inc.	XFL	24	1.7	1.7	0.24[e]	0.10	100	no	NA	NA	NA	NA
Chloride Systems	Infinity Series II (ac only)	60	1.8	3.6	0.87	0.77	NS	no	NA	NA	NA	NA
Chloride Systems	Infinity Series II	30	8.6	8.5	0.90	0.88	NS	yes	nickel cadmium	1.5	72	yes
Emergi-Lite	Escort Series	40	1.7	1.7	0.16	0.16	20	yes	lead calcium 6 V	1.5	168	yes

NA = not applicable

NS = not supplied

1 lb = 0.45 kg

[a] All signs use the same lamp for operating under both utility power and emergency power systems unless otherwise noted. The expression “inc. lum.” indicates increased sign luminance under emergency conditions; “no” indicates that the sign does not have any of the emergency options described in the “Data Tables” section of *Specifier Reports: Exit Signs* (p. 15).

[b] This sign uses a linear T5 fluorescent lamp.

[c] Warranty is prorated based on how many years of the warranty have elapsed.

[d] This sign uses an incandescent lamp as an emergency light source.

[e] High power factor is available on this sign.

Brown-out Circuitry	Auto Discharge/ Recharge Cycle	Emergency Options[a]	Sign Format(s)	Available Color(s) of Letters	Available Color(s) of Background	Housing Material	Weight (lb)	Mounting	Impact Resistant	Tamper Resistant	Warranty Period (yr)	Warranty on Internal Battery (yr)
yes	no	no	edge lit	green, red, white	clear, green, mirror, red, white	aluminum, steel	20.0	bracket, ceiling, wall	no	no	1	1 full + 14 prorata[c]
yes	no	inc. lum.	stencil, panel	green, red, white	aluminum, black, bronze, green, red, white	aluminum	10.0	bracket, ceiling, recessed, universal, wall	yes	yes	1	1 full + 14 prorata[c]
yes	no	flash, flash and buzz[d]	stencil, panel	green, red, white	aluminum, black, green, red, white	steel	6.0	bracket, ceiling, pendant, universal, wall	yes	yes	1	1 full + 14 prorata[c]
NA	NA	no	stencil, open face	green, red, white	aluminum, black, green, red, white	die-cast aluminum	10.0	bracket, ceiling, wall	no	yes	lifetime	NA
yes	no	flash[d]	stencil, open face	green, red, white	aluminum, black, green, red, white	die-cast aluminum	11.0	bracket, ceiling, wall	no	yes	lifetime	1 full + 10 prorata[c]
yes	no	flash[d]	stencil, open face	green, red, white	black, green, matte chrome, red, white	steel	5.0	bracket, ceiling, pendant, universal, wall	no	yes	lifetime	1 full + 10 prorata[c]
NA	NA	no	stencil, open face	green, red, white	black, green, matte chrome, red, white	steel	4.0	bracket, ceiling, pendant, universal, wall	no	yes	lifetime	NA
NS	NS	no	edge lit	red	clear, white	steel	5.0	bracket, ceiling, recessed, wall	NS	no	lifetime	NS
NA	NA	no	stencil	red	aluminum, black	die-cast aluminum	10.0	bracket, ceiling, wall	no	yes	lifetime	NA
yes	no	inc. lum.	stencil	red	aluminum, black	die-cast aluminum	11.0	bracket, ceiling, wall	no	yes	lifetime	1 full + 10 prorata[c]
yes	no	inc. lum.	stencil	red	black, matte chrome, white	steel	5.0	bracket, ceiling, pendant, universal, wall	no	yes	lifetime	1 full + 10 prorata[c]
NA	NA	no	stencil	red	black, matte chrome, white	steel	4.0	bracket, ceiling, pendant, universal, wall	no	yes	lifetime	NA
NA	NA	no	stencil	green, red	black, white	thermoplastic	2.0	bracket, ceiling, universal, wall	yes	yes	5	NA
yes	no	inc. lum., flash, flash and buzz	stencil	green, red	black, white	thermoplastic	2.5	bracket, ceiling, universal, wall	yes	yes	5	1 full + 7 prorata[c]
yes	yes	flash	stencil	red	aluminum, black, white	plastic (polycarbonate)	2.5	bracket, ceiling, pendant, universal, wall	yes	yes	3 (sign), 5 (lights)	3 full + 3 prorata[c]

Table 1 (continued). Manufacturer-Supplied Information: Exit Signs (listed by type of light source)

Manufacturer	Trade Name	Number of Light Sources	Rated Active Power (W) at		Power Factor at		Rated Lamp Life (yr)	Battery Mode	Battery Type	Battery Operating Time (h)	Battery Recharge Time (h)	Low Battery Voltage Disconnect
			120 V	277 V	120 V	277 V						
LED (Diffuser) (continued)												
Emergi-Lite	Preceptor Series	40	1.7	1.7	0.16	0.16	20	yes	lead calcium 6 V	1.5	168	yes
Emergi-Lite	X10 Series	40	1.7	1.7	0.16	0.16	20	yes	lead calcium or nickel cadmium 6 V	1.5	168	yes
Emergi-Lite	X40 Series	76	3.8	3.8	0.47	0.47	20	yes	nickel cadmium 6 V	1.5	168	yes
Exide Lightguard	E700/750 Series (ac only)	60	1.8	3.6	0.87	0.77	NS	no	NA	NA	NA	NA
Exide Lightguard	E700/750 Series	30	8.6	8.5	0.90	0.88	NS	yes	nickel cadmium	1.5	72	yes
Kenall Mfg. Company	Trailmate	NS	3.2	3.2	NS	NS	25	yes	lead calcium 6 V	5	24	yes
Mule	Embassy	32	1.8	1.9	0.15	0.15	85.6	yes	lead calcium 6 V	1.5	12	yes
Sure-Lites	Pinnacle Die Cast Exit	147 (red), 125 (green)	7.6 (red), 7.0 (green)	7.9 (red), 7.2 (green)	0.77 (red), 0.76 (green)	0.76 (red), 0.75 (green)	>28.5	yes	nickel cadmium 6 V	1.5	<24	yes
Sure-Lites	Pinnacle Die Cast Exit	147 (red), 125 (green)	8.8 (red), 8.5 (green)	9.2 (red), 8.8 (green)	0.81 (red), 0.82 (green)	0.81 (red), 0.82 (green)	>28.5	yes	nickel cadmium 6 V	1.5	<24	yes
Sure-Lites	Standard Steel LED Exit	40	1.8	2.6	>0.17	>0.09	28.5	yes	lead calcium or nickel cadmium 6 V	1.5 or 2	<24	yes
Sure-Lites	Thin Profile LED Exit	147 (red), 125 (green)	8.8 (red), 8.5 (green)	9.2 (red), 8.8 (green)	0.81 (red), 0.82 (green)	0.81 (red), 0.82 (green)	>28.5	yes	nickel cadmium 6 V	1.5	<24	yes
LED (Prismatic Diffuser)												
Self-Powered Lighting, Inc.	HJ-5	66	5.0	5.0	0.80	0.80	80	yes	lead calcium or nickel cadmium 6 V	3	24	no
Self-Powered Lighting, Inc.	SW-1	86	1.0	1.0	0.30	0.30	80	no	NA	NA	NA	NA
Radioluminescent												
Self-Powered Lighting, Inc.	700c-Omniglo	10	0.0	0.0	NA	NA	10 to 20	NA	NA	NA	NA	NA

NA = not applicable

NS = not supplied

1 lb = 0.45 kg

a All signs use the same lamp for operating under both utility power and emergency power systems unless otherwise noted. The expression “inc. lum.” indicates increased sign luminance under emergency conditions; “no” indicates that the sign does not have any of the emergency options described in the “Data Tables” section of *Specifier Reports: Exit Signs* (p. 15).

b Warranty is prorated based on how many years of the warranty have elapsed.

c This sign uses an incandescent lamp as an emergency light source.

d Length of warranty is specified at time of purchase.

Brown-out Circuitry	Auto Discharge/ Recharge Cycle	Emergency Options[a]	Sign Format(s)	Available Color(s) of Letters	Available Color(s) of Background	Housing Material	Weight (lb)	Mounting	Impact Resistant	Tamper Resistant	Warranty Period (yr)	Warranty on Internal Battery (yr)
yes	yes	flash	stencil	red	aluminum, black, bronze, white	aluminum	4.1	bracket, ceiling, pendant, recessed, wall	yes	yes	3 (sign), 5 (lights)	3 full + 5 prorata[b]
yes	yes	flash	stencil	red	aluminum, black, bronze, white	steel	2.5	bracket, ceiling, universal, wall	yes	yes	3 (sign), 5 (lights)	3 full + 3 prorata[b]
yes	no	flash	edge lit	green, red	clear, white	aluminum, steel	7.0	bracket, ceiling, pendant, recessed, wall	no	no	5	5 full + 7 prorata[b]
NA	NA	no	stencil	green, red	black, white	thermoplastic	2.0	bracket, ceiling, universal, wall	yes	yes	5	NA
yes	no	inc. lum., flash, flash and buzz	stencil	green, red	black, white	thermoplastic	2.5	bracket, ceiling, universal, wall	yes	yes	5	1 full + 7 prorata[b]
yes	yes	flash, flash and buzz	matrix	green, red	white	polycarbonate	4.5	bracket, ceiling, universal, wall	yes	yes	3	0
yes	no	inc. lum., flash, flash and buzz[c]	stencil	red	aluminum, black, bronze, green, white	aluminum, steel	2.0	bracket, ceiling, pendant, recessed, universal, wall	yes	yes	1	1
yes	no	flash, flash and buzz	stencil	green, red	aluminum, black, bronze, white	aluminum	8.0	bracket, ceiling, universal, wall	yes	yes	1	1 full + 14 prorata[b]
yes	no	flash, flash and buzz	stencil	green, red	aluminum, black, bronze, white	aluminum	9.0	bracket, ceiling, universal, wall	yes	yes	1	1 full + 14 prorata[b]
yes	no	inc. lum., flash, flash and buzz[c]	stencil, panel	red	black, white	steel	5.0	bracket, ceiling, pendant, universal, wall	yes	yes	1	1 full + 14 prorata[b]
yes	no	flash, flash and buzz	stencil	green, red	aluminum, black, bronze, white	aluminum	14.0	recessed	yes	yes	1	1 full + 14 prorata[b]
yes	yes	flash, flash and buzz	matrix	green, red	aluminum, black, bronze, white (other colors special order)	steel	3.75 (4.5 with battery)	bracket, ceiling, pendant, recessed, universal, wall	no	no	25	5
NA	NA	no	stencil	green, red	aluminum, black, white	steel	2.25	wall	yes	yes	10	NA
NA	NA	no	matrix	green	black, green, red	thermoplastic	1.5	bracket, ceiling, pendant, universal, wall	yes	yes	10, 12, 15, or 20[d]	NA

Table 2. Manufacturer-Supplied Information: Retrofit Kits (listed by type of retrofit light source)

Manufacturer	Trade Name	Number of Light Sources per Sign	Color(s) of Light Source	Available Voltages	Rated Active Power (W) at		Power Factor at 120 V
					120 V	277 V	
Host Sign							
Lithonia Lighting	Quantum	2	white	120/277	24.0	26.0	0.95
Compact Fluorescent							
Area Lighting Research Inc.	Enviro-Lite	1	white	120/277	9.0	NS	0.60
Sure-Lites	Compact Fluorescent Retrofit Kit	1 or 2	white	120	8.1	NA	>0.40
Electroluminescent							
Loctite Luminescent Systems	Exit Saver	1	green	120	0.3	NA	0.19
Loctite Luminescent Systems	Exit Saver	1	green	120/277	1.3	1.4	0.66
Incandescent							
Flexlite, Inc	Exlite	2	white	120	5.0	NA	0.99
Flexlite, Inc	Exlite	1	white	120/277	8.1	11.2	0.99
Standard Enterprises, Inc.	Eterna Lamp™	2	white	120	5.0	NA	1.00
LED							
Area Lighting Research Inc.	Enviro-Lite	1	green, red	120/277	3.0	NS	0.11
Chloride Systems	Infinity Series II	2	red	120/277	2.0	3.6	0.84
Dioptrics Technologies, Inc.	Di-TECH	16	red	120/277	3.0	3.0	1.00
Dioptrics Technologies, Inc.	Di-TECH	16	red	120/277	4.0	4.0	1.00
Emergi-Lite	LED-RX	40	red	120	1.7	NA	0.16
Emergi-Lite	LED-RX	40	red	120/277	1.7	1.7	0.16
Exide Lightguard	E700/750 Series	2	red	120/277	2.0	3.6	0.84
Mule	Embassy	32	red	120/277	1.8	1.9	0.15
Prolight, Inc.	Prolight	36	red	120/277	2.5 (±10%)	2.1 (±10%)	0.21

NA = not applicable

NS = not supplied

1 in. = 2.54 cm

1 oz = 28 g

[a] Retrofit kits that use a rewire connection cannot be UL listed. Thus the UL 924 status shown only applies to the double-contact bayonet, quick-connector, and screw-in connections.

[b] This retrofit kit has been tested by ETL Testing Laboratories, Inc. to the applicable requirements of UL 924.

[c] This kit is a tube 0.5 inches in diameter by 10 inches long.

[d] This kit is a tube 0.5 inches in diameter by 20 inches long.

[e] Each lamp is 0.75 inches in diameter by 4 inches long.

[f] Only the red sign is UL listed.

[g] This kit comprises two strips of LEDs, which are mounted at either end of the host sign. Dimensions are given for each strip.

Rated Lamp Life (yr)	Weight of Kit (oz)	Method of Connection[a]	Width (in.)	Height (in.)	Depth (in.)	UL 924 Status	Warranty Period (yr)
2.2	NA	NA	NA	NA	NA	listed	3
1.1	5	rewire, screw in	6.00	6.00	1.00	listed	2
1.1	25	screw in	5.00	5.00	1.50	classified	1
30	7	rewire	9.78	6.47	1.30	tested[b]	5
30	7	rewire	9.78	6.47	1.30	tested[b]	5
13	<1	screw in	[c]	NA	NA	classified	5
13	<1	screw in	[d]	NA	NA	classified	5
15	7	double-contact bayonet, screw in	[e]	NA	NA	classified	5
69	8	rewire, screw in	9.50	4.50	0.75	listed[f]	25
30	10	quick connector, screw in	0.88[g]	6.00[g]	1.13[g]	listed	25
80	7	rewire, screw in	0.50	0.60	0.75	listed	25
80	13	rewire, screw in	0.50	0.60	0.75	listed	25
20	6	rewire, screw in	9.50	3.13	0.75	listed	5
20	12	quick connector, rewire	9.50	6.19	0.75	classified and listed	5
30	10	quick connector, screw in	0.88[g]	6.00[g]	1.13[g]	listed	25
86	8	double-contact bayonet, rewire, screw in	10.00	7.00	1.50	listed	25
25	8	screw in	10.75	7.00	<2.50	listed	25

Table 3. NLPIP-Measured Data: Exit Signs (listed by type of light source)

Manufacturer	Trade Name	Catalog No.	Sign Format	Letter Color	Background Color	Regulated Power Supply				
						Mean Letter Luminance (cd/m^2)	Letter Luminance Range (cd/m^2)	Mean Background Luminance (cd/m^2)	Background Luminance Range (cd/m^2)	Luminance Contrast
Compact Fluorescent										
Sure-Lites	ELX Series Fluorescent Edgelit Exit	ELX-5170-BSRARC	edge lit	red	clear	28	13–49	7.5	3.0–14	0.73
Sure-Lites	Pinnacle Die Cast Exit	CAX-510000-R	stencil	red	aluminum	200	56–810	3.9	0.77–10	0.98
Sure-Lites	Steel Compact Fluorescent Exit	PLX-5200-RP	stencil	red	white	290	89–740	8.8	4.0–15	0.97
Incandescent										
Big Beam Emergency Systems, Inc.	DLWX	DLWXIRAB	stencil	red	aluminum	30	11–69	0.63	0.22–1.2	0.98
Big Beam Emergency Systems, Inc.	EDLWX	EDLWXIRAB	stencil	red	aluminum	49	11–220	1.0	0.19–2.5	0.98
Big Beam Emergency Systems, Inc.	ELWX	ELWXIRWW	stencil	red	white	39	8.5–110	0.85	0.25–2.3	0.98
Big Beam Emergency Systems, Inc.	LWX	LWXIRWW	stencil	red	white	30	4.9–180	0.52	0.12–1.9	0.98
LED (Diffuser)										
ALKCO	LED EDGE-GLO	RC-LED	edge lit	red	clear	11	8.6–15	0.29	0.18–0.43	0.97
Big Beam Emergency Systems, Inc.	DXLS	DXLSIRAB	stencil	red	aluminum	8.3	2.7–19	0.18	0.07–0.67	0.98
Big Beam Emergency Systems, Inc.	EDXLS	EDXLSIRAB	stencil	red	aluminum	6.7	2.4–15	0.16	0.07–0.48	0.98
Big Beam Emergency Systems, Inc.	EXFL	EXFLIRWW	stencil	red	white	10	5.5–18	0.19	0.09–0.43	0.98
Big Beam Emergency Systems, Inc.	XFL	XFLIRWW	stencil	red	white	13	6.9–23	0.29	0.14–0.91	0.98
Big Beam Emergency Systems, Inc.	XFL-HPF	XFLIRWW-HPF	stencil	red	white	8.1	4.3–16	0.19	0.09–0.47	0.98
Chloride Systems	Infinity Series II (ac only)	LACWP1R	stencil	red	white	19	11–33	0.47	0.16–0.73	0.97
Chloride Systems	Infinity Series II	LSPNWP1R	stencil	red	white	18	7.8–37	0.43	0.23–0.77	0.98
Emergi-Lite	Escort Series	LEDWX32R-EI	stencil	red	white	13	3.2–16	0.30	0.10–0.76	0.98
Emergi-Lite	Preceptor Series	LEDPXLIR-EI	stencil	red	aluminum	12	8.0–17	0.25	0.11–0.65	0.98
Emergi-Lite	X10 Series	LEDWX12R-120	stencil	red	white	16	9.1–22	0.40	0.18–1.0	0.98
Emergi-Lite	X40 Series	LX42RW	edge lit	red	white	15	7.3–28	0.78	0.24–1.9	0.95
Exide Lightguard	E700/750 Series (ac only)	E700WPSR	stencil	red	white	19	11–33	0.47	0.16–0.73	0.97
Exide Lightguard	E700/750 Series	EPN700WPSR	stencil	red	white	18	7.8–37	0.43	0.23–0.77	0.98
Kenall Mfg. Company	Trailmate	6504	stencil	red	white	20	14–27	0.66	0.26–1.7	0.97
Mule	Embassy	PSX	stencil	red	white	8.6	4.3–17	0.12	0.07–0.18	0.99
Sure-Lites	Pinnacle Die Cast Exit	CAX-610000-RB	stencil	red	black	58	52–72	1.5	0.82–2.6	0.97
Sure-Lites	Pinnacle Die Cast Exit	CAX-717000-RB	stencil	red	black	47	39–54	0.87	0.35–2.3	0.98
Sure-Lites	Standard Steel LED Exit	R-1-CLED	stencil	red	white	15	8.3–21	0.36	0.12–0.85	0.98
Sure-Lites	Thin Profile LED Exit	TPX-717000-R	stencil	red	aluminum	50	36–65	0.96	0.32–1.8	0.98
LED (Prismatic Diffuser)										
Self-Powered Lighting, Inc.	HJ-5	HJ5-AC1-RBA	matrix	red	aluminum	12	6.6–21	0.44	0.20–1.3	0.96
Self-Powered Lighting, Inc.	SW-1	SW1-RWW	stencil	red	aluminum	73	28–150	0.66	0.16–1.5	0.99
Radioluminescent										
Self-Powered Lighting, Inc.	700c-Omniglo	700c-1-10-BR	stencil	green	red	0.38[b]	0.31–0.48[b]	0.00[b]	0.00–0.01[b]	0.99[b]

1 ft = 0.30 m 1 cd/m^2 = 0.29 fL NA = not applicable NT = not tested because the sign that was submitted did not include a battery

NLPIP measured data for one sample of each sign. All luminance and power measurements are rounded to two significant digits, except where this would exceed the measurement precision.

Luminance contrast values take the form $(L_1-L_2)/L_1$, where L_1 and L_2 are the mean letter and mean background luminances, with L_1 being the greater of these two values.

Battery-Operated								Readability (Out of 14, the Number of Subjects Unable to Identify Letter Orientation at Each Distance)			
								Lights Off		Lights On	
Mean Letter Luminance (cd/m^2)	Letter Luminance Range (cd/m^2)	Mean Background Luminance (cd/m^2)	Background Luminance Range (cd/m^2)	Luminance Contrast	Active Power[a] (W) at 120 V	Power Factor at 120 V	Apparent Power (rms VA) at 120 V	100 ft	150 ft	100 ft	150 ft
7.3	4.1–13	2.5	0.96–6.7	0.66	23	0.54	43	8	13	3	12
NT	NT	NT	NT	NT	11	0.41	28	0	5	0	3
NT	NT	NT	NT	NT	16	0.44	37	0	3	0	1
NA	NA	NA	NA	NA	12	0.94	13	0	4	1	10
19	2.8–69	0.35	0.12–1.3	0.98	15	0.93	17	1	4	0	6
51	8.0–210	1.2	0.23–8.5	0.98	15	0.92	16	0	2	0	2
NA	NA	NA	NA	NA	13	0.97	13	0	7	1	8
NT	NT	NT	NT	NT	5.1	0.74	7.0	1	3	1	4
NA	NA	NA	NA	NA	1.9	0.24	7.8	0	3	4	10
12	4.3–27	0.30	0.11–0.95	0.98	2.2	0.30	7.2	1	2	3	7
19	10–34	0.42	0.18–0.97	0.98	1.6	0.22	7.1	0	2	0	3
NA	NA	NA	NA	NA	1.8	0.23	7.7	0	2	0	2
NT	NT	NT	NT	NT	5.1	1.0	5.2	0	1	0	3
NA	NA	NA	NA	NA	2.3	0.90	2.5	0	1	0	0
16	6.9–34	0.39	0.16–0.71	0.98	8.3	0.89	9.4	0	2	0	3
NT	NT	NT	NT	NT	1.5	0.09	16	0	2	1	5
16	9.8–20	0.34	0.14–0.82	0.98	4.3	0.46	9.4	0	2	0	3
NT	NT	NT	NT	NT	1.8	0.17	11	0	2	1	4
NT	NT	NT	NT	NT	3.9	0.47	8.3	0	1	0	2
NA	NA	NA	NA	NA	2.3	0.90	2.5	0	1	0	0
16	6.9–34	0.39	0.16–0.71	0.98	8.3	0.89	9.4	0	2	0	3
NT	NT	NT	NT	NT	2.9	0.35	8.3	0	1	0	2
120	40–800	2.0	1.1–4.5	0.98	2.9	0.30	9.7	0	1	0	3
NT	NT	NT	NT	NT	7.6	0.83	9.2	0	1	0	0
41	33–48	1.1	0.49–2.6	0.97	9.2	0.83	11	0	2	0	0
NT	NT	NT	NT	NT	1.6	0.15	10	2	3	0	6
50	36–65	0.98	0.36–1.8	0.98	9.4	0.81	12	0	5	0	3
NT	NT	NT	NT	NT	1.0	0.22	4.7	0	1	2	9
NA	NA	NA	NA	NA	8.7	0.84	10	0	2	1	3
NA	NA	NA	NA	NA	NA	NA	NA	3	8	2	9

[a] The presence of a battery may increase the active power of a sign.

[b] The luminances of this sign were too low to be measured accurately with CapCalc. The luminances reported for this sign were measured using a Minolta LS 100 luminance meter. As a result, this sign's visibility in smoke could not be evaluated because NLPIP's calculation method requires a CapCalc input file; this sign therefore is not listed in Table 5.

Table 4. NLPIP-Measured Data: Retrofit Kits (listed by type of retrofit light source)

Manufacturer	Trade Name	Catalog No.	Mean Letter Luminance (cd/m^2)	Letter Luminance Range (cd/m^2)	Mean Background Luminance (cd/m^2)
Host Sign					
Lithonia Lighting[a]	Quantum	QMSW3R120	110	50–210	3.2
Compact Fluorescent					
Area Lighting Research Inc.	Enviro-Lite	EXU-120	370	94–1900	9.2
Sure-Lites	Compact Fluorescent Retrofit Kit	RKX-7-U	370	48–1800	5.9
Electroluminescent					
Loctite Luminescent Systems	Exit Saver	2001-AA-120-H-02	16	16–17	0.23
Loctite Luminescent Systems	Exit Saver	2001-AA-120/277-H-02	15	14–15	0.29
Incandescent					
Flexlite, Inc	Exlite	FL120(9)-B,C,E,I	18	6.5–38	0.40
Flexlite, Inc	Exlite	FL120-B,C,E,I	32	10–58	0.62
Standard Enterprises, Inc.	Eterna Lamp	ETS5/120	22	12–64	0.51
LED					
Area Lighting Research Inc.	Enviro-Lite	LED-120	10	3.9–18	0.26
Chloride Systems	Infinity Series II	ILRKIT1	13	8.4–21	0.23
Dioptrics Technologies, Inc.	Di-TECH	DT-1000	19	12–34	0.46
Dioptrics Technologies, Inc.	Di-TECH	DT-2000	16	9.2–28	0.32
Emergi-Lite	LED-RX	LED-RX-1	9.2	3.9–20	0.20
Emergi-Lite	LED-RX	LED-RX-120-F	22	15–29	0.53
Exide Lightguard	E700/750 Series	E50LR1	13	8.4–21	0.23
Mule	Embassy	941002	8.7	5.0–12	0.18
Prolight, Inc.	Prolight	XLEDR-QLC	19	13–42	0.42

1 ft = 0.30 m

1 cd/m^2 = 0.29 fL

NLPIP measured data for one sample of each retrofit kit. All luminance and power measurements are rounded to two significant digits, except where this would exceed the measurement precision.

Luminance contrast values take the form $(L_1-L_2)/L_1$, where L_1 and L_2 are the mean letter and mean background luminances, with L_1 being the greater of these two values.

[a] NLPIP measured the performance of a new host sign specimen of the same broad and catalog number as that used in *Specifier Reports: Exit Signs*.

Background Luminance Range (cd/m^2)	Luminance Contrast	Active Power (W) at 120 V	Power Factor at 120 V	Apparent Power (rms VA) at 120 V	Readability (Out of 14, the Number of Subjects Unable to Identify Letter Orientation at Each Distance)			
					Lights Off		Lights On	
					100 ft	150 ft	100 ft	150 ft
1.6–8.8	0.97	23	1.0	23	0	4	0	2
2.4–27	0.98	11	0.53	21	0	5	0	0
2.3–16	0.98	11	0.53	20	0	4	0	0
0.07–0.46	0.99	1.5	0.23	6.6	0	1	1	3
0.08–0.79	0.98	1.2	0.67	1.8	0	1	0	4
0.09–0.92	0.97	8.9	1.0	8.9	0	3	1	5
0.16–1.6	0.97	7.9	1.0	7.9	0	1	0	1
0.21–1.3	0.98	11	1.0	11	0	2	0	3
0.10–0.47	0.97	2.9	0.52	5.6	1	3	5	10
0.10–0.46	0.98	2.4	0.94	2.5	1	1	0	4
0.19–0.92	0.98	3.7	0.94	4.0	0	1	0	2
0.13–0.63	0.98	4.1	0.95	4.3	0	2	0	2
0.07–0.54	0.98	1.3	0.17	7.8	1	5	1	7
0.23–1.2	0.98	1.8	0.17	10	0	1	0	2
0.10–0.46	0.98	2.4	0.94	2.5	1	1	0	4
0.07–0.54	0.98	1.5	0.14	11	0	1	0	2
0.16–0.73	0.98	2.8	0.21	13	0	1	0	0

Table 5. Calculated Data: Visibility in Smoke for Exit Signs (listed by type of light source)

Manufacturer	Trade Name	Catalog No.	Sign Format	Letter Color	Background Color	Clear-Air Conditions: Regulated Power Supply: Mean Letter Luminance (cd/m^2)	Clear-Air Conditions: Regulated Power Supply: Mean Background Luminance (cd/m^2)	Clear-Air Conditions: Regulated Power Supply: Luminance Contrast
Compact Fluorescent								
Sure-Lites	ELX Series Fluorescent Edgelit Exit	ELX-5170-BSRARC	edge lit	red	clear	28	7.5	0.73
Sure-Lites	Pinnacle Die Cast Exit	CAX-510000-R	stencil	red	aluminum	200	3.9	0.98
Sure-Lites	Steel Compact Fluorescent Exit	PLX-5200-RP	stencil	red	white	290	8.8	0.97
Incandescent								
Big Beam Emergency Systems, Inc.	DLWX	DLWXIRAB	stencil	red	aluminum	30	0.63	0.98
Big Beam Emergency Systems, Inc.	EDLWX	EDLWXIRAB	stencil	red	aluminum	49	1.0	0.98
Big Beam Emergency Systems, Inc.	ELWX	ELWXIRWW	stencil	red	white	39	0.85	0.98
Big Beam Emergency Systems, Inc.	LWX	LWXIRWW	stencil	red	white	30	0.52	0.98
LED (Diffuser)								
ALKCO	LED EDGE-GLO	RC-LED	edge lit	red	clear	11	0.29	0.97
Big Beam Emergency Systems, Inc.	DXLS	DXLSIRAB	stencil	red	aluminum	8.3	0.18	0.98
Big Beam Emergency Systems, Inc.	EDXLS	EDXLSIRAB	stencil	red	aluminum	6.7	0.16	0.98
Big Beam Emergency Systems, Inc.	EXFL	EXFLIRWW	stencil	red	white	10	0.19	0.98
Big Beam Emergency Systems, Inc.	XFL	XFLIRWW	stencil	red	white	13	0.29	0.98
Big Beam Emergency Systems, Inc.	XFL-HPF	XFLIRWW-HPF	stencil	red	white	8.1	0.19	0.98
Chloride Systems	Infinity Series II (ac only)	LACWP1R	stencil	red	white	19	0.47	0.97
Chloride Systems	Infinity Series II	LSPNWP1R	stencil	red	white	18	0.43	0.98
Emergi-Lite	Escort Series	LEDWX32R-EI	stencil	red	white	13	0.30	0.98
Emergi-Lite	Preceptor Series	LEDPXLIR-EI	stencil	red	aluminum	12	0.25	0.98
Emergi-Lite	X10 Series	LEDWX12R-120	stencil	red	white	16	0.40	0.98
Emergi-Lite	X40 Series	LX42RW	edge lit	red	white	15	0.78	0.95
Exide Lightguard	E700/750 Series (ac only)	E700WPSR	stencil	red	white	19	0.47	0.97
Exide Lightguard	E700/750 Series	EPN700WPSR	stencil	red	white	18	0.43	0.98
Kenall Mfg. Company	Trailmate	6504	stencil	red	white	20	0.66	0.97
Mule	Embassy	PSX	stencil	red	white	8.6	0.12	0.99
Sure-Lites	Pinnacle Die Cast Exit	CAX-610000-RB	stencil	red	black	58	1.5	0.97
Sure-Lites	Pinnacle Die Cast Exit	CAX-717000-RB	stencil	red	black	47	0.87	0.98
Sure-Lites	Standard Steel LED Exit	R-1-CLED	stencil	red	white	15	0.36	0.98
Sure-Lites	Thin Profile LED Exit	TPX-717000-R	stencil	red	aluminum	50	0.96	0.98
LED (Prismatic Diffuser)								
Self-Powered Lighting, Inc.	HJ-5	HJ5-AC1-RBA	matrix	red	aluminum	12	0.44	0.96
Self-Powered Lighting, Inc.	SW-1	SW1-RWW	stencil	red	aluminum	73	0.66	0.99

1 ft = 0.30 m

1 cd/m^2 = 0.29 fL

NA = not applicable

NT = not tested because the sign that was submitted did not include a battery

Calculated smoke simulation values are based on measurements in clear-air conditions.

All luminance measurements are rounded to two significant digits, except where this would exceed the measurement precision.

Luminance contrast values take the form $(L_1-L_2)/L_1$, where L_1 and L_2 are the mean letter and mean background luminances, with L_1 being the greater of these two values.

Clear-Air Conditions			Smoke Simulations							
Battery-Operated			Regulated Power Supply				Battery-Operated			
Mean Letter Luminance (cd/m^2)	Mean Background Luminance (cd/m^2)	Luminance Contrast	Mean Letter Luminance at 16 ft (cd/m^2)	Mean Background Luminance at 16 ft (cd/m^2)	Luminance Contrast at 16 ft	Critical Distance (ft)	Mean Letter Luminance at 16 ft (cd/m^2)	Mean Background Luminance at 16 ft (cd/m^2)	Luminance Contrast at 16 ft	Critical Distance (ft)
7.3	2.5	0.66	7.3	7.5	0.00	36	0.47	0.37	0.23	20
NT	NT	NT	5.8	2.0	0.66	33	NT	NT	NT	NT
NT	NT	NT	8.6	3.0	0.65	35	NT	NT	NT	NT
NA	NA	NA	0.93	0.34	0.63	25	NA	NA	NA	NA
19	0.35	0.98	1.4	0.45	0.68	27	0.46	0.16	0.66	21
51	1.2	0.98	1.1	0.37	0.66	26	1.4	0.45	0.68	26
NA	NA	NA	0.80	0.20	0.76	23	NA	NA	NA	NA
NT	NT	NT	0.28	0.03	0.91	18	NT	NT	NT	NT
NA	NA	NA	0.20	0.01	0.93	16	NA	NA	NA	NA
12	0.30	0.98	0.15	0.00	1.0	16	0.35	0.08	0.76	19
19	0.42	0.98	0.32	0.05	0.83	19	0.50	0.15	0.70	21
NA	NA	NA	0.36	0.08	0.76	19	NA	NA	NA	NA
NT	NT	NT	0.24	0.00	0.99	17	NT	NT	NT	NT
NA	NA	NA	0.53	0.17	0.69	21	NA	NA	NA	NA
16	0.39	0.98	0.54	0.16	0.70	21	0.47	0.12	0.74	21
NT	NT	NT	0.37	0.10	0.74	19	NT	NT	NT	NT
16	0.34	0.98	0.34	0.06	0.81	19	0.43	0.11	0.76	20
NT	NT	NT	0.42	0.11	0.74	20	NT	NT	NT	NT
NT	NT	NT	0.42	0.13	0.69	20	NT	NT	NT	NT
NA	NA	NA	0.53	0.17	0.69	21	NA	NA	NA	NA
16	0.39	0.98	0.54	0.16	0.70	21	0.47	0.12	0.74	21
NT	NT	NT	0.58	0.20	0.66	22	NT	NT	NT	NT
120	2.0	0.98	0.23	0.00	1.0	17	3.0	0.70	0.76	30
NT	NT	NT	1.6	0.45	0.71	26	NT	NT	NT	NT
41	1.1	0.97	1.3	0.37	0.70	26	1.1	0.35	0.70	25
NT	NT	NT	0.43	0.14	0.68	20	NT	NT	NT	NT
50	0.98	0.98	1.3	0.40	0.70	26	1.3	0.40	0.70	26
NT	NT	NT	0.25	0.00	0.98	18	NT	NT	NT	NT
NA	NA	NA	1.7	0.39	0.77	28	NA	NA	NA	NA

Table 6. Calculated Data: Visibility in Smoke for Retrofit Kits (listed by type of retrofit light source)

Manufacturer	Trade Name	Catalog No.	Clear-Air Conditions		
			Mean Letter Luminance (cd/m^2)	Mean Background Luminance (cd/m^2)	Luminance Contrast
Host Sign					
Lithonia Lighting[a]	Quantum	QMSW3R120	110	3.2	0.97
Compact Fluorescent					
Area Lighting Research Inc.	Enviro-Lite	EXU-120	370	9.2	0.98
Sure-Lites	Compact Fluorescent Retrofit Kit	RKX-7-U	370	5.9	0.98
Electroluminescent					
Loctite Luminescent Systems	Exit Saver	2001-AA-120-H-02	16	0.23	0.99
Loctite Luminescent Systems	Exit Saver	2001-AA-120/277-H-02	15	0.29	0.98
Incandescent					
Flexlite, Inc	Exlite	FL120(9)-B,C,E,I	16	0.40	0.97
Flexlite, Inc	Exlite	FL120-B,C,E,I	24	0.62	0.97
Standard Enterprises, Inc.	Eterna Lamp	ETS5/120	22	0.51	0.98
LED					
Area Lighting Research Inc.	Enviro-Lite	LED-120	10	0.26	0.97
Chloride Systems	Infinity Series II	ILRKIT1	13	0.23	0.98
Dioptrics Technologies, Inc.	Di-TECH	DT-1000	19	0.46	0.98
Dioptrics Technologies, Inc.	Di-TECH	DT-2000	16	0.32	0.98
Emergi-Lite	LED-RX	LED-RX-1	9.2	0.20	0.98
Emergi-Lite	LED-RX	LED-RX-120-F	22	0.53	0.98
Exide Lightguard	E700/750 Series	E50LR1	13	0.23	0.98
Mule	Embassy	941002	8.7	0.18	0.98
Prolight, Inc.	Prolight	XLEDR-QLC	19	0.42	0.98

1 ft = 0.30 m

1 cd/m^2 = 0.29 fL

Calculated smoke simulation values are based on measurements in clear-air conditions.

All luminance measurements are rounded to two significant digits, except where this would exceed the measurement precision.

Luminance contrast values take the form $(L_1-L_2)/L_1$, where L_1 and L_2 are the mean letter and mean background luminances, with L_1 being the greater of these two values.

[a] NLPIP measured the performance of a new host sign specimen of the same brand and catalog number as that used in *Specifier Reports: Exit Signs*.

Smoke Simulations			
Mean Letter Luminance at 16 ft (cd/m^2)	**Mean Background Luminance at 16 ft (cd/m^2)**	**Luminance Contrast at 16 ft**	**Critical Distance (ft)**
3.3	1.2	0.64	31
11	4.1	0.62	36
9.8	2.7	0.73	35
0.52	0.11	0.78	21
0.44	0.10	0.78	20
0.48	0.14	0.71	21
0.69	0.25	0.64	23
0.65	0.22	0.66	22
0.32	0.08	0.75	19
0.36	0.07	0.81	19
0.58	0.17	0.71	22
0.45	0.12	0.74	20
0.32	0.04	0.89	19
0.64	0.20	0.68	23
0.36	0.07	0.81	19
0.28	0.02	0.93	18
0.58	0.16	0.72	22

Underwriters Laboratories, Inc. 1991. *Standard for Safety: Emergency Lighting and Power Equipment*, UL 924. Northbrook, IL: Underwriters Laboratories.

National Lighting Product Information Program Publications

Guide to Performance Evaluation of Efficient Lighting Products, 1991

Specifier Reports:

Power Reducers, 1992
Specular Reflectors, 1992
Occupancy Sensors, 1992
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Screwbase Compact Fluorescent Lamp Products, 1993
Cathode-Disconnect Ballasts, 1993
Exit Signs, 1994
Electronic Ballasts, 1994
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Specifier Reports Supplements:

Screwbase Compact Fluorescent Lamp Products, 1994
Electronic Ballasts, 1995

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T8 Fluorescent Lamps, 1993
Multilayer Polarizer Panels, 1993
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Power Quality, 1995
Thermal Effects in 2'×4' Fluorescent Lighting Systems, 1995

NATIONAL LIGHTING PRODUCT INFORMATION PROGRAM

Specifier Reports *Supplements*

Exit Signs

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Author: Andrew Bierman
Program Director: Robert Davis
Editor: Amy Fowler
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ENERGY STAR Exit Signs

The US Environmental Protection Agency (US EPA) and the US Department of Energy (US DOE) administer a labeling program, called ENERGY STAR, for products that meet defined energy efficiency specifications. The ENERGY STAR program for exit signs began on September 1, 1996. Specifications are detailed on the US EPA's web site (http://www.epa.gov). To contact the ENERGY STAR office by telephone, call 1-888-STAR YES (782-7937), by fax 1-202-233-9575, or by mail, Manager ENERGY STAR Program, US EPA Atmospheric Pollution Prevention Division, 401 M St., Washington, DC 20460.

UL 924 Standard

Underwriters Laboratory (UL) has revised the standard for exit signs (UL 924). The first phase of the revised standard took effect on August 27, 1996. Additional requirements will become effective in phases through May 2001. The new standards will include changes in visibility testing protocols and the size, shape, and visibility of the directional indicators (chevrons). There are also changes in testing protocols and visibility requirements for exit sign retrofit kits. For a copy of UL 924, contact Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112. Telephone: 1-800-854-7179, e-mail: global@ihs.com.

This second supplement to *Specifier Reports: Exit Signs* (1994) contains information about energy-efficient, single-faced exit signs and retrofit conversion kits. Most of the exit signs and retrofit kits described in this supplement use light emitting diodes (LEDs) to illuminate the signs. The tables contain information supplied by the manufacturers of the products as well as the results of testing conducted by NLPIP. Exit signs from manufacturers that responded to NLPIP's request for product information and product samples by April 1, 1997 are included. NLPIP tested these exit signs during June and July 1997 at the Lighting Research Center Laboratory in Watervliet, New York.

This supplement differs from *Specifier Reports: Exit Signs* and the first supplement in the following ways:

- NLPIP did not perform readability tests using human observers for this report because the data previously presented clearly showed that higher luminance, greater contrast, and greater letter and background uniformity increase sign readability. As a guideline, for signs to be readable at 100 feet (ft), they should have a luminance of at least 15 candelas/square meter (cd/m^2), a contrast between letters and background of at least 0.8, and a letter luminance uniformity of less than 20:1.
- NLPIP used a new digital camera system (Photometrics, Series 200) for photometric testing and calibrated the images captured with this system using luminance measurements of each sign taken with a Pritchard 703A spectroradiometer. For previous reports NLPIP used a CapCalc video photometer.
- The "Impact Resistant" and "Tamper Resistant" columns have been combined into a "Vandal Resistant" column.
- Most manufacturers submitted two versions of the same exit sign: one with red LEDs and one with green LEDs. Unlike broad band (white) light sources such as incandescent and compact fluorescent lamps, which only vary photometrically depending on the color of the diffuser, LEDs vary both photometrically and electrically depending on the color of the LEDs used. NLPIP tested both versions wherever two were submitted.

Table 1. Manufacturer-Supplied Information: Exit Signs (listed by light source)

Manufacturer	Trade Name	Identification	Number of Light Sources	Rated Active Power (W) at 120 V	Rated Active Power (W) at 277 V	Power Factor at 120 V	Power Factor at 277 V	Rated Lamp Life (yr)	Battery Type[a]	Battery Life (yr)	Battery Operating Time (h)	Full Battery Recharge Time (h)
LED												
Chloride Systems tel 910-259-1000 fax 800-258-8803	Reference Series II	RLN1RW	64	10.8	NS	NS	NS	25	PbCa NiCAD	8	1.5	24
	Reference Series II	RLN1GW	64	3.04	NS	0.46	NS	25	PbCa NiCAD	8	1.5	24
Dynaray tel 860-388-3007 fax 860-388-6550	PDQ82 Series	82W14	64	NS	NS	NS	NS	10	NiCAD	15	2	168
	PDQ82 Series	82W14G	64	NS	NS	NS	NS	10	NiCAD	15	2	168
Exide Lightguard tel 910-259-1131 fax 800-403-6927	E800	E803WSR	64	10.8	NS	NS	NS	25	PbCa NiCAD	8 12	1.5	24
	E800	E803WSG	64	3.04	NS	0.46	NS	25	PbCa NiCAD	8 12	1.5	24
Hubbell Lighting tel 540-382-6111 fax 540-382-1526	C Series	CWARAL9	36	1.37	1.56	0.14	0.06	80	NA	NA	NA	NA
	C Series	CWPGWL9	36	6.57	6.80	0.85	0.77	80	NiCAD	10	1.5	24
	Pathfinder	PUPRWL9	36	8.3	8.5	0.74	0.72	80	PbCa	8–10	1.5	24
	Pathfinder	PUPGWL9	36	9.4	9.5	0.77	0.75	80	PbCa	8–10	1.5	24
Juno Lighting tel 847-827-9880 fax 847-296-4056	Universal Voltage	EXR51-WH	16	4.2	4.6	0.66	0.54	25	PbCa	10	2.0	<24
	Universal Voltage	EXG51-WH	28	6.3	6.6	0.70	0.55	25	PbCa	10	2.0	<24
Lithonia Emergency Systems tel 770-987-4200 fax 770-981-8141	Quantum	LQMSW1R 120/277ELN	14	0.75	0.95	0.14	0.07	25	NiCAD	7–9	1.5	168
	Quantum	LQMSW1G 120/277ELN	8	0.77	1.0	0.15	0.07	25	NiCAD	7–9	1.5	168
	Extreme	LVSW1R120 /277ELN	54	2.3	2.2	0.20	0.10	25	NiCAD	7–9	1.5	168
	Extreme	LVSW1G120 /277ELN	24	1.7	1.9	0.18	0.10	25	NiCAD	7–9	1.5	168

NA = not applicable
NS = not supplied

[a] NiCAD = nickel cadmium
PbCa = lead calcium

[b] FL = flasher
Bz = buzzer
BF = buzzer and flasher
FAI = fire alarm interface
ER = extended battery-run time
2CKT = 120 V and 277 V operation

[c] W = white
B = black
BrAl = brushed aluminum
Al = aluminum
Cl = clear
Br = bronze
S = silver
M = mirror

[d] DCAl = diecast aluminum
TP = thermoplastic
Al = aluminum
DCST = diecast steel
PC = polycarbonate
ExAl = extruded aluminum
SS = stainless steel
ST = steel

[e] U = universal
W = wall
C = conduit
VW = vertical wall
E = end
B = back
T = top
F = flush
R = recessed

Low Battery Voltage Disconnect	Brownout Circuitry	Auto Discharge/ Recharge Cycle	Emergency Options[b]	Sign Format(s)	Available Background Color(s)[c]	Housing Material[d]	Weight (lb)	Mounting[e]	Vandal Resistant	Sign Warranty Period (yr)	Warranty on Internal Battery[f] (yr)
yes	yes	yes	FL, Bz, BF, ER, 2CKT, FAI	stencil	W, B, BrAl	DCAl	7	U	yes	5	5
yes	yes	yes	FL, Bz, BF, ER, 2CKT, FAI	stencil	W, B, BrAl	DCAl	7	U	yes	5	5
no	yes	no	FAI, FL, Bz	stencil	W, B, Al	TP	5	U	yes	5	5 + 7PR
no	yes	no	FAI, FL, Bz	stencil	W, B, Al	TP	5	U	yes	5	5 + 7PR
yes	yes	yes	FL, Bz, BF, ER, 2CKT, FAI	stencil	W, B	DCAl	7	U	yes	5	5
yes	yes	yes	FL, Bz, BF, ER, 2CKT, FAI	stencil	W, B	DCAl	7	U	yes	5	5
yes	yes	yes	NA	diffused stencil	W, B, S	DC	3.5	T, B, E	yes	3	3 + 5PR
yes	yes	yes	FAI, FL, Bz	diffused stencil	W, B, S	DCAl	4.5	T, B, E	yes	3	3 + 5PR
yes	yes	yes	FAI	stencil	W	TP	5.5	W, U	yes	3	3 + 5PR
yes	yes	yes	FAI	stencil	W	TP	5.5	W, U	yes	3	3 + 5PR
yes	yes	no	2CKT	stencil	W, B	PC	3	U	yes	1	1 + 5PR
yes	yes	no	2CKT	stencil	W, B	PC	3	U	yes	1	1 + 5PR
no	no	no	FAI, FL	stencil	W, B	PC	1.3	U	no	5	5
no	no	no	FAI, FL	stencil	W, B	PC	1.3	U	no	5	5
no	no	yes	FL	stencil	W, B, Al	DCAl	9	T, B, E, C	yes	5	5
no	no	yes	FL	stencil	W, B, Al	DCAl	9	T, B, E, C	yes	5	5

[f] PR = prorated

Table 1 (continued). Manufacturer-Supplied Information: Exit Signs (listed by light source)

Manufacturer	Trade Name	Identification	Number of Light Sources	Rated Active Power (W) at 120 V	Rated Active Power (W) at 277 V	Power Factor at 120 V	Power Factor at 277 V	Rated Lamp Life (yr)	Battery Type[a]	Battery Life (yr)	Battery Operating Time (h)	Full Battery Recharge Time (h)
LED												
Prescolite tel 510-562-3500 fax 510-577-5019	Exit Lite	EX1LEDREMFA	72	8	8	0.81	0.81	NS	PbCa	6–10	1.5	24
	Exit Lite	EX1LEDGEMFA	72	9.4	9.2	0.85	0.87	NS	PbCa	6–10	1.5	24
	PEX Exit Series	PEXLIRENW	12	3.6	3.5	0.86	0.84	NS	NiCAD	12	1.5	24
	PEX Exit Series	PEXLIGENW	78	13	13	0.92	0.92	NS	NiCAD	12	1.5	24
Sure-Lites tel 847-806-3859 fax 847-956-8423	CAX Series	CAX717000RWLP	99	7.4	7.5	0.72	0.72	25	NiCAD	15	1.5	24
	CAX Series	CAX717000GW	100	8.5	8.7	0.79	0.79	25	NiCAD	15	1.5	24
	CAX Series	CAX1LEDSPRW	40	8.4	8.3	0.92	0.92	NS	PbCa NiCAD	8–10 15	NS	24
	CCX Series	CCX70GWH	NS	10.8	10.4	0.97	0.95	NS	PbCa	8–10	1.5	24
	CCX Series	CCX71RWHDH	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Yorklite Electronics tel 215-244-4201 fax 215-244-4208	Sentor	ALXSPWR1U	30	4.5	4.5	0.85	0.85	25	NiCAD	10	2.0	24
Edgelit LED												
Chloride Systems	Sterling Series	STELSW1RW3	14	5.19	5.55	0.86	0.83	25+	NiCAD	12	1.5	24
	Sterling Series	STELSW1GW3	12	4.24	4.24	0.79	0.79	25+	NiCAD	12	1.5	24
Dynaray	91 Series	D91R14LEDRC	75	NS	NS	NS	NS	10	NiCAD	15	1.5	168
	91 Series	D91R14LEDGC	95	NS	NS	NS	NS	10	NiCAD	15	1.5	168
Exide Lightguard	Slim Line	SLELSWSRW3	14	5.19	5.55	0.86	0.83	25+	NiCAD	12	1.5	24
	Slim Line	SLELSWSGW3	12	4.24	4.24	0.79	0.79	25+	NiCAD	12	1.5	24
Lithonia Emergency Systems	Precise	LRPW1RW120/277ELN	30	2.3	2.7	0.21	0.10	25	NiCAD	7–10	1.5	168
	Precise	LRPW1GW120/277ELN	18	1.7	1.9	0.20	0.10	25	NiCAD	7–10	1.5	168

NA = not applicable
NS = not supplied

[a] NiCAD = nickel cadmium
PbCa = lead calcium

[b] FL = flasher
Bz = buzzer
BF = buzzer and flasher
FAI = fire alarm interface
ER = extended battery-run time
2CKT = 120 V and 277 V operation

[c] W = white
B = black
BrAl = brushed aluminum
Al = aluminum
Cl = clear
Br = bronze
S = silver
M = mirror
R = red

[d] DCAl = diecast aluminum
TP = thermoplastic
Al = aluminum
DCST = diecast steel
PC = polycarbonate
ExAl = extruded aluminum
SS = stainless steel
ST = steel

[e] U = universal
W = wall
C = conduit
VW = vertical wall
E = end
B = back
T = top
F = flush
R = recessed

Low Battery Voltage Disconnect	Brownout Circuitry	Auto Discharge/ Recharge Cycle	Emergency Options[b]	Sign Format(s)	Available Background Color(s)[c]	Housing Material[d]	Weight (lb)	Mounting[e]	Vandal Resistant	Sign Warranty Period (yr)	Warranty on Internal Battery[f] (yr)
yes	yes	NS	FAI, FL, Bz	matrix	W, B, BrAl	TP	7.2	U	yes	12	6
yes	yes	NS	FAI, FL, Bz	matrix	W, B, BrAl	TP	7.2	U	yes	12	6
yes	yes	NS	FAI, FL, Bz	stencil, matrix	W, B	TP	6.5	U	yes	12	12
yes	yes	NS	FAI, FL, Bz	stencil, matrix	W, B	TP	6.5	U	yes	12	12
yes	yes	no	FAI, FL, Bz	stencil	W, B, Bz, BrAl	DCAl	NS	U	yes	1	15
yes	yes	no	FAI, FL, Bz	stencil	W, B, Bz, BrAl	DCAl	NS	U	yes	1	15
yes	yes	no	FAI, FL, Bz	stencil	W, B, Bz, BrAl	DCAl	NS	C, B, E	yes	1	5 10
yes	yes	no	FAI, FL, Bz	stencil	W, B	PC	NS	U	yes	1	5 PR
NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
yes	yes	no	FAI, FL, Bz	stencil	W, B, BrAl	DCAl	4.8	U	yes	5	5
yes	yes	no	2CKT	edgelit	Cl, W	ST, Al	12	C, W, VW	NS	3	5
yes	yes	no	2CKT	edgelit	Cl, W	ST, Al	12	C, W, VW	NS	3	5
no	yes	no	FAI, 2CKT	edgelit	Cl, W, M	DCAl	12	C, W	yes	5	7 PR
no	yes	no	FAI, 2CKT	edgelit	Cl, W, M	DCAl	12	C, W	yes	5	7 PR
yes	yes	no	2CKT	edgelit	Cl, W	ST, Al	12	C, W, VW	NS	3	5
yes	yes	no	2CKT	edgelit	Cl, W	ST, Al	12	C, W, VW	NS	3	5
no	no	no	FL, FAI, BF	edgelit	Cl, W, M	ACR	5.8	T, E, B	no	5	5
no	no	no	FL, FAI, BF	edgelit	Cl, W, M	ACR	5.8	T, E, B	no	5	5

[f] PR = prorated

Table 1 (continued). Manufacturer-Supplied Information: Exit Signs (listed by light source)

Manufacturer	Trade Name	Identification	Number of Light Sources	Rated Active Power (W) at 120 V	Rated Active Power (W) at 277 V	Power Factor at 120 V	Power Factor at 277 V	Rated Lamp Life (yr)	Battery Type[a]	Battery Life (yr)	Battery Operating Time (h)	Full Battery Recharge Time (h)
Edgelit LED (continued)												
Prescolite	Edge-Lit Series	LERR6EMEWH	12	3.6	3.5	0.86	0.84	NS	NiCAD	12	1.5	24
	Edge-Lit Series	LERG6EMEWH	NS	13	13	0.92	0.92	NS	NiCAD	12	1.5	24
Sure-Lites	ELX Series	ELX7170RWDAC	56	7.3	7.5	0.91	0.90	NS	NiCAD	NS	1.5	24
	ELX Series	ELX7170GWDAC	96	9.7	9.9	0.93	0.92	NS	NiCAD	NS	1.5	24
Yorklite Electronics	CLX Series	CLXSPCR1WR	14	<8	<8	0.85	0.85	25	NiCAD	5	1.5	24
	CLX Series	CLXSPCR1WG	12	<6	<6	0.85	0.85	25	NiCAD	5	1.5	24
Direct View LED												
Chloride Systems	Infinity	ISPLWP1R	88	6	NS	NS	NS	25+	NiCAD	12	1.5	24
	Infinity	ISPLWP1G	88	6	NS	NS	NS	25+	NiCAD	12	1.5	24
Exide Lightguard	Miser	MSPLWP1WR	88	6	NS	NS	NS	25+	NiCAD	12	1.5	24
	Miser	MSPLWP1WG	88	6	NS	NS	NS	25+	NiCAD	12	1.5	24
Hubbell Lighting	Freedom Series	LED1ACRWW	90	5.7	5.8	0.81	0.80	80	NA	NA	NA	NA
Radioluminescent												
Exide Lightguard	LS Self-Luminous Series	L3GU10SBK	1	NA	NA	NA	NA	10+	NA	NA	NA	NA

NA = not applicable
NS = not supplied

[a] NiCAD = nickel cadmium
PbCa = lead calcium

[b] FL = flasher
Bz = buzzer
BF = buzzer and flasher
FAI = fire alarm interface
ER = extended battery-run time
2CKT = 120 V and 277 V operation

[c] W = white
B = black
BrAl = brushed aluminum
Al = aluminum
Cl = clear
Br = bronze
S = silver
M = mirror
R = red

[d] DCAl = diecast aluminum
TP = thermoplastic
Al = aluminum
DCST = diecast steel
PC = polycarbonate
ExAl = extruded aluminum
SS = stainless steel
ST = steel

[e] U = universal
W = wall
C = conduit
VW = vertical wall
E = end
B = back
T = top
F = flush
R = recessed

Low Battery Voltage Disconnect	Brownout Circuitry	Auto Discharge/ Recharge Cycle	Emergency Options[b]	Sign Format(s)	Available Background Color(s)[c]	Housing Material[d]	Weight (lb)	Mounting[e]	Vandal Resistant	Sign Warranty Period (yr)	Warranty on Internal Battery[f] (yr)
yes	yes	NS	none	edgelit	Cl, W, M	DCST	8	R	NS	12	12
yes	yes	NS	none	edgelit	Cl, W, M	DCST	8	R	NS	12	12
no	yes	no	FAI, FL, Bz	edgelit	Cl, W, M	ACR	NS	C, E, W	NS	1	15
no	yes	no	FAI, FL, Bz	edgelit	Cl, W, M	ACR	NS	C, E, W	NS	1	15
yes	no	no	none	edgelit	Cl, W	SS	5.75	U	yes	3	3
yes	no	no	none	edgelit	Cl, W	SS	5.75	U	yes	3	3
yes	yes	yes	FAI, FL, Bz, BF, 2CKT	matrix	W, B, BrAl	TP, DCAl	5	U	yes	5	7
yes	yes	yes	FAI, FL, Bz, BF, 2CKT	matrix	W, B, BrAl	TP, DCAl	5	U	yes	5	7
yes	yes	yes	FAI, FL, Bz BF, 2CKT	matrix	W, B, BrAl	TP, DCAl	5	U	yes	5	7
yes	yes	yes	FA, FL, Bz BF, 2CKT	matrix	W, B, BrAl	TP, DCAl	5	U	yes	5	7
yes	yes	yes	NS	stencil	W, B, BrAl	ExAl	4.75	U	yes	5	3+5PR
NA	NA	NA	NA	stencil	R, G, B	ABS	2.0	C, W, F	yes	10	NA

[f] PR = prorated

Table 2. Manufacturer-Supplied Information: Retrofit Kits

Manufacturer	Trade Name	Model Number	Number of Light Sources	Rated Active Power (W) at 120 V	Rated Active Power (W) at 277 V	Rated Lamp Life (yr)	Weight of Kit (lb)	Method of Connection
Dynaray	NS	DLITE-B1	60	3	NS	20	NS	screw in
Emergi-Lite tel 860-399-7991 fax 860-399-7996	Quickswitch	QSC	60	3	NS	25	0.17	screw in
Flexlite, Inc. tel 800-932-9899 fax 732-417-2129	White Light Star Burst	STAR-white	18	8	11	13.2	0.21	screw in plug in
	Red Star Burst	STAR-red	36	2	NS	25	0.29	screw in plug in
Standard Enterprises tel 703-490-3300 fax 703-497-2316	Wattman	SWR120C with red diffuser	56	2	NS	50–80	0.13	screw in
	Wattman	SWG120C with green diffuser	6	2	NS	50–80	0.08	screw in
Sure-Lites	NS	RKX7U with red diffuser	NS	NS	NS	NS	NS	screw in, plug in
Teron Lighting tel 513-858-6004 fax 513-858-6038	Ultra II	UA2C RED	40	2	NS	25	0.21	screw in
	Ultra II	UA2C GREEN	40	2	NS	25	0.21	screw in
Yorklite Electronics	Convertalite	YLAR-U	30	2.1	2.1	25	0.25	rewire

NS = not supplied

Table 3. NLPIP-Measured Data: Exit Signs (listed by type of light source)

Manufacturer	Trade Name	Identification	Directly Measured: Rated Active Power at 120 V[a] (W)	Directly Measured: Power Factor at 120 V	Power Type
LED					
Chloride Systems	Reference Series II	RLN1RW	7.2	0.63 lag	ac battery
	Reference Series II	RLN1GW	12.9	0.84 lag	ac battery
Dynaray	PDQ82 Series	82W14	5.2	0.40 lag	ac battery
	PDQ82 Series	82W14G	7.3	0.57 lag	ac battery
Exide Lightguard	E800	E803WSR	7.2	0.63 lag	ac battery
	E800	E803WSG	12.9	0.84 lag	ac battery

Note: Column headings and NLPIP testing procedures are described in *Specifier Reports: Exit Signs*.

[a] Measurements are accurate to within ±2%. Values are reported to three digits when the first significant digit is less than five, two digits in the other cases to reflect 2.5 significant digits.

[b] Measurements are accurate to within ±5%. Values are reported to three digits when the first significant digit is less than two, two digits in other cases to reflect 2.2 significant digits.

[c] Measurement is taken at the same time and resolution as letter luminance measurements, and data are reported to the same number of decimal places.

[d] Results of simulations are reported with the same number of significant digits as the corresponding measured values.

Width (in.)	Height (in.)	Depth (in.)	Warranty Period (yr)
4.7	0.83	0.83	5
NS	NS	NS	5
5.7	5.7	0.63	10
5.9	5.9	0.65	30
5.1	0.75	0.75	25
4.5	0.75	0.75	25
4.75	5.6	1.48	NS
5.3	0.9	0.9	10
5.1	0.85	0.85	10
6.4	2.24	1.5	10

Clear-Air Conditions					Smoke Simulations			
Luminance Contrast	Mean Letter Luminance[b] (cd/m²)	Letter Luminance Range[b] (cd/m²)	Mean Background Luminance[c] (cd/m²)	Background Luminance Range[c] (cd/m²)	Luminance Contrast	Mean Letter Luminance[d] (cd/m²)	Mean Background Luminance[d] (cd/m²)	Critical Distance (ft)
>0.99	14.7	8.4–22	<0.1	<0.3	0.69	0.41	0.13	21
>0.99	17.5	9.8–26	<0.2	<0.3	0.69	0.49	0.15	21
>0.99	13.4	7.5–22	<0.1	<0.2	0.71	0.36	0.11	20
>0.99	17.3	9.5–29	<0.1	<0.2	0.71	0.47	0.14	21
>0.99	24	16.8–30	<1	<1	0.69	0.68	0.21	22
>0.99	18.2	12.5–23	<0.2	<0.3	0.69	0.51	0.16	21
>0.99	9.5	6.3–11.9	<0.1	<0.1	0.71	0.26	0.08	18
>0.99	8.2	5.4–10.2	<0.1	<0.1	0.71	0.22	0.06	17
>0.99	14.7	8.4–22	<0.1	<0.3	0.69	0.41	0.13	21
>0.99	17.5	9.8–26	<0.2	<0.3	0.69	0.49	0.15	21
>0.99	13.4	7.5–22	<0.1	<0.2	0.71	0.36	0.11	20
>0.99	17.3	9.5–29	<0.1	<0.2	0.71	0.47	0.14	21

Table 3 (continued). NLPIP-Measured Data: Exit Signs (listed by type of light source)

Manufacturer	Trade Name	Identification	Directly Measured: Rated Active Power at 120 V[a] (W)	Directly Measured: Power Factor at 120 V	Power Type
LED (continued)					
Hubbell Lighting	C Series (ac only)	CWARAL9	1.48	0.16 lead	ac
	C Series	CWPGWL9	6.7	0.85 lag	ac battery
	Pathfinder	PUPRWL9	8.2	0.83 lag	ac battery
	Pathfinder	PUPGWL9	8.8	0.81 lag	ac battery
Juno Lighting	Universal Voltage	EXR51-WH	4.15	0.44 lead	ac battery
	Universal Voltage	EXG51-WH	6.0	0.46 lead	ac battery
Lithonia Lighting	Quantum	LQMSW1R120/277ELN	0.75	0.14 lead	ac battery
	Quantum	LQMSW1G120/277ELN	0.80	0.15 lead	ac battery
	Extreme	LVSW1R120/277ELN	3.45	0.21 lead	ac battery
	Extreme	LVSW1G120/277ELN	2.29	0.22 lead	ac battery
Prescolite	Exit Lite	EX1LEDREMFA	7.0	0.82 lag	ac battery
	Exit Lite	EX1LEDGEMFA	8.6	0.87 lag	ac battery
	PEX Exit Series	PEXL1RENW	3.34	0.86 lag	ac battery
	PEX Exit Series	PEXL1GENW	11.6	0.93 lag	ac
Sure-Lites	CAX Series	CAX717000RWLP	3.86	0.70 lag	ac battery
	CAX Series	CAX717000GW	8.3	0.81 lag	ac battery
	CAX Series	CAX1LEDSPRW	5.3	0.74 lag	ac battery
	CAX Series	CCX70GWH	5.2	0.68 lead	ac battery
	CCX Series	CCX71RWHDH	4.11	0.53 lead	ac battery
Yorklite Electronics	Sentor	ALXSPWR1U	4.61	0.77 lag	ac battery

Note: Column headings and NLPIP testing procedures are described in *Specifier Reports: Exit Signs*.

[a] Measurements are accurate to within ±2%. Values are reported to three digits when the first significant digit is less than five, two digits in the other cases to reflect 2.5 significant digits.

[b] Measurements are accurate to within ±5%. Values are reported to three digits when the first significant digit is less than two, two digits in other cases to reflect 2.2 significant digits.

[c] Measurement is taken at the same time and resolution as letter luminance measurements, and data are reported to the same number of decimal places.

[d] Results of simulations are reported with the same number of significant digits as the corresponding measured values.

Clear-Air Conditions					Smoke Simulations			
Luminance Contrast	Mean Letter Luminance[b] (cd/m^2)	Letter Luminance Range[b] (cd/m^2)	Mean Background Luminance[c] (cd/m^2)	Background Luminance Range[c] (cd/m^2)	Luminance Contrast	Mean Letter Luminance[d] (cd/m^2)	Mean Background Luminance[d] (cd/m^2)	Critical Distance (ft)
>0.99	57	26–82	<1	<1	0.71	1.53	0.44	28
0.99	14.9	7–21	<0.2	<0.3	0.70	0.41	0.12	21
0.99	19.3	9–28	<0.2	<0.3	0.70	0.52	0.16	22
0.99	12.0	9.1–15.6	<0.1	<0.2	0.67	0.35	0.11	20
0.99	38	17.4–118	<1	<1	0.69	1.12	0.35	25
0.99	6.6	3.1–12.0	<0.1	<0.1	0.68	0.18	0.06	16
>0.99	350	63–2300	<10	<10	0.76	9.6	2.3	35
>0.99	21	15.3–32	<1	<1	0.69	0.61	0.19	22
>0.99	17.6	12.7–27	<0.1	<0.2	0.69	0.51	0.16	21
>0.99	12.6	8.8–17.7	<0.1	<0.1	0.69	0.36	0.11	20
>0.99	8.9	6.2–12.6	<0.1	<0.1	0.69	0.25	0.08	18
>0.99	13.2	7.3–25	<0.1	<0.2	0.69	0.37	0.12	20
>0.99	6.6	3.6–12.5	<0.1	<0.1	0.69	0.19	0.06	16
>0.99	11.0	8.1–15.9	<0.1	<0.1	0.68	0.31	0.10	19
>0.99	5.8	4.3–8.5	<0.1	<0.1	0.67	0.17	0.05	16
0.96	60	43–75	2	1–3	0.67	1.68	0.55	28
0.96	55	39–68	2	1–3	0.67	1.54	0.50	28
0.97	20	13.6–30	1	<1	0.68	0.58	0.19	22
0.97	26	17–38	1	<1	0.68	0.73	0.23	23
>0.99	28	19.1–40	<1	<1	0.70	0.80	0.24	23
>0.99	45	30–65	<1	<1	0.70	1.28	0.38	27
>0.99	8.6	6.8–11.9	<0.1	<0.1	0.71	0.24	0.07	17
>0.99	8.3	6.6–11.5	<0.1	<0.1	0.71	0.23	0.07	17
>0.99	21	17–27	<1	<1	0.67	0.62	0.20	22
>0.99	25	19.5–32	<1	<1	0.67	0.72	0.23	22
>0.99	4.5	3.7–5.7	<0.1	<0.1	0.68	0.13	0.04	15
>0.99	24	17.8–30	<1	<1	0.70	0.67	0.20	22
>0.99	62	46–77	<1	<1	0.70	1.73	0.52	28
>0.99	18.6	14.6–27	<0.2	<0.2	0.70	0.52	0.16	22
>0.99	21	16.3–31	<1	<1	0.70	0.59	0.18	22
0.99	24	6.2–52	<1	<1	0.66	0.72	0.24	23
0.99	146	38–600	<2	<4	0.72	4.2	1.2	32
>0.99	9.7	6.7–14.6	<0.1	<0.1	0.68	0.28	0.09	19
>0.99	230	77–780	<10	<10	0.70	6.7	2.0	33
>0.99	17.8	10.5–24	<0.2	<0.2	0.68	0.52	0.17	22
>0.99	154	49–710	<2	<3	0.71	4.5	1.3	32
>0.99	15.1	9.3–19.5	<0.1	<0.2	0.69	0.43	0.13	21
>0.99	17.1	10.6–22	<0.1	<0.2	0.69	0.49	0.15	21

Table 3 (continued). NLPIP-Measured Data: Exit Signs (listed by type of light source)

Manufacturer	Trade Name	Identification	Directly Measured: Rated Active Power at 120 V[a] (W)	Directly Measured: Power Factor at 120 V	Power Type
Edgelit LED					
Chloride Systems	Sterling Series	STELSW1RW3	9.3	0.85 lag	ac battery
	Sterling Series	STELSW1GW3	14.7	0.92 lag	ac battery
Dynaray	91 Series	D91R14LEDRC	4.60	0.39 lag	ac battery
	91 Series	D91R14LEDGC	6.7	0.48 lag	ac battery
Exide Lightguard	Slim Line	SLELSWSRW3	9.3	0.85 lag	ac battery
	Slim Line	SLELSWSGW3	14.7	0.92 lag	ac battery
Lithonia Lighting	Precise	LRPW1RW120/277ELN	2.16	0.21 lead	ac battery
	Precise	LRPW1GW120/277ELN	1.77	0.23 lead	ac battery
Prescolite	Edge-Lit Series	LERR6EMEWH	4.79	0.90 lag	ac battery
Sure-Lites	ELX Series	ELX7170RWDAC	8.2	0.92 lead	ac battery
	ELX Series	ELX7170GWDAC	9.4	0.94 lag	ac battery
Yorklite Electronics	CLX Series	CLXSPCR1WR	9.3	0.90 lag	ac battery
	CLX Series	CLXSPCR1WG	15.2	0.92 lag	ac battery

Note: Column headings and NLPIP testing procedures are described in *Specifier Reports: Exit Signs*.

[a] Measurements are accurate to within ±2%. Values are reported to three digits when the first significant digit is less than five, two digits in the other cases to reflect 2.5 significant digits.

[b] Measurements are accurate to within ±5%. Values are reported to three digits when the first significant digit is less than two, two digits in other cases to reflect 2.2 significant digits.

[c] Measurement is taken at the same time and resolution as letter luminance measurements, and data are reported to the same number of decimal places.

[d] Results of simulations are reported with the same number of significant digits as the corresponding measured values.

Clear-Air Conditions					Smoke Simulations			
Luminance Contrast	Mean Letter Luminance[b] (cd/m²)	Letter Luminance Range[b] (cd/m²)	Mean Background Luminance[c] (cd/m²)	Background Luminance Range[c] (cd/m²)	Luminance Contrast	Mean Letter Luminance[d] (cd/m²)	Mean Background Luminance[d] (cd/m²)	Critical Distance (ft)
0.95	7.7	4.9–12.3	0.4	0.1–1.4	0.58	0.26	0.11	18
0.95	8.3	5.2–14	0.4	0.1–1.5	0.58	0.28	0.12	19
0.66	2.5	1.06–5.0	0.9	0.2–2.3	0.35	0.12	0.079	14
0.65	3.7	1.55–7.3	1.3	0.3–3.3	0.34	0.18	0.120	16
0.98	13.2	7.8–20	0.3	0.1–0.5	0.67	0.38	0.12	20
0.98	9.6	5.7–14.6	0.2	0.1–0.4	0.67	0.27	0.09	18
0.97	4.4	2.6–7.1	0.1	0.1–0.2	0.64	0.13	0.048	15
0.97	3.7	2.2–6.0	0.1	<0.2	0.64	0.11	0.040	14
0.95	7.7	4.9–12.3	0.4	0.1–1.4	0.58	0.26	0.11	18
0.95	8.3	5.2–14	0.4	0.1–1.5	0.58	0.28	0.12	19
0.66	2.5	1.06–5.0	0.9	0.2–2.3	0.35	0.12	0.079	14
0.65	3.7	1.55–7.3	1.3	0.3–3.3	0.34	0.18	0.120	16
0.92	14.3	8.3–21	1.1	0.4–2.0	0.57	0.47	0.20	21
0.92	18.7	10.8–27	1.4	0.5–2.6	0.58	0.62	0.26	22
0.88	37	20–67	4.5	1.3–8.2	0.49	1.40	0.72	28
0.88	47	25–83	5.8	1.6–12.5	0.48	1.75	0.90	29
0.93	11.6	4.6–23	0.9	0.2–3.1	0.48	0.45	0.24	21
0.93	24	9.8–46	2	<6.3	0.49	0.92	0.47	24
0.90	9.6	6.1–2.3	1.0	0.3–2.0	0.51	0.33	0.16	20
0.89	11.8	7.5–15.2	1.2	0.4–2.4	0.51	0.41	0.20	21
0.77	5.7	3.0–8.0	1.3	0.5–4.5	0.32	0.27	0.18	18
0.78	6.2	3.3–8.6	1.4	0.5–5.2	0.32	0.30	0.20	19
0.95	7.9	4.7–13.5	0.4	0.1–1.1	0.62	0.25	0.10	18
0.95	8.6	4.9–15.2	0.4	0.1–1.2	0.61	0.28	0.11	18
0.55	1.83	0.97–3.4	0.83	0.26–2.2	0.23	0.11	0.086	14
0.56	2.5	1.31–4.7	1.1	0.3–2.9	0.24	0.16	0.119	15

Table 3 (continued). NLPIP-Measured Data: Exit Signs (listed by type of light source)

Manufacturer	Trade Name	Identification	Directly Measured: Rated Active Power at 120 V[a] (W)	Directly Measured: Power Factor at 120 V	Power Type
Direct View LED					
Chloride Systems	Infinity	ISPLWP1R	11.3	0.90 lag	ac battery
	Infinity	ISPLWP1G	10.6	0.91 lag	ac battery
Exide Lightguard	Miser	MSPLWP1WR	11.3	0.90 lag	ac battery
	Miser	MSPLWP1WG	10.6	0.91 lag	ac battery
Hubbell Lighting (AC only)	Freedom Series	LED1ACRWW	5.2	0.76 lag	ac
Radioluminescent					
Exide Lightguard	LS Self-Luminous Series	L3GU10SBK	NA	NA	self

Note: Column headings and NLPIP testing procedures are described in *Specifier Reports: Exit Signs*.

[a] Measurements are accurate to within ±2%. Values are reported to three digits when the first significant digit is less than five, two digits in the other cases to reflect 2.5 significant digits.

[b] Measurements are accurate to within ±5%. Values are reported to three digits when the first significant digit is less than two, two digits in other cases to reflect 2.2 significant digits.

[c] Measurement is taken at the same time and resolution as letter luminance measurements, and data are reported to the same number of decimal places.

[d] Results of simulations are reported with the same number of significant digits as the corresponding measured values.

Table 4. NLPIP-Measured Data: Retrofit Kits

Manufacturer	Trade Name	Identification	Directly Measured: Rated Active Power at 120 V[a] (W)	Directly Measured: Power Factor at 120 V
Retrofit Kits				
Base Case RED Diffuser	NA	NA	23.1	1.0
Base Case GREEN Diffuser	NA	NA	23.0	1.0
Dynaray	NS	DLITE-B1	3.0	0.40 lead
Emergi-Lite	Quickswitch	QS-C	3.1	0.49 lead
Flexlite	White Light Star Burst	STAR-C (with red diffuser)	9.5	1.0
	White Light Star Burst	STAR-C (with green diffuser)	9.5	1.0
	Red Star burst	BURST-R	1.9	0.99 lead
Standard Enterprises	Wattman	SWR120C (with red diffuser)	4.00	0.47 lead
	Wattman	SWG120C (with green diffuser)	0.64	0.12 lead
Sure-Lites	NS	RKX7U (with red diffuser)	10.7	0.52 lag
	NS	RKX7U (with green diffuser)	10.7	0.51 lag
Teron Lighting	Ultra II	UA2C GREEN	3.35	0.23 lead
Yorklite Electronics	Convertalite	YLAR-U	2.19	0.39 lead

Note: Column headings and NLPIP testing procedures are described in *Specifier Reports: Exit Signs*.

NA = not applicable
NS = not supplied

[a] Measurements are accurate to within ±2%. Values are reported to three digits when the first significant digit is less than five, two digits in the other cases to reflect 2.5 significant digits.

[b] Measurements are accurate to within ±5%. Values are reported to three digits when the first significant digit is less than two, two digits in other cases to reflect 2.2 significant digits.

Clear-Air Conditions					Smoke Simulations			
Luminance Contrast	Mean Letter Luminance[b] (cd/m²)	Letter Luminance Range[b] (cd/m²)	Mean Background Luminance[c] (cd/m²)	Background Luminance Range[c] (cd/m²)	Luminance Contrast	Mean Letter Luminance[b] (cd/m²)	Mean Background Luminance[d] (cd/m²)	Critical Distance (ft)
>0.99	130	57–290	<1	<1	0.79	3.2	0.67	31
>0.99	187	81–410	<1	<1	0.79	4.7	0.97	32
>0.99	94	49–146	<1	<1	0.77	2.4	0.55	30
>0.99	104	58–157	<1	<1	0.77	2.6	0.60	30
>0.99	130	57–290	<1	<1	0.79	3.2	0.67	31
>0.99	187	81–410	<1	<1	0.79	4.7	0.97	32
>0.99	94	49–146	<1	<1	0.77	2.4	0.55	30
>0.99	104	58–157	<1	<1	0.77	2.6	0.60	30
>0.99	39	24–64	<1	<1	0.77	0.96	0.22	24
>0.99	0.37	0.26–0.48	<0.01	<0.01	0.75	0.0097	0.0025	<3

Clear-Air Conditions					Smoke Simulations			
Luminance Contrast	Mean Letter Luminance[b] (cd/m²)	Letter Luminance Range[b] (cd/m²)	Mean Background Luminance[c] (cd/m²)	Background Luminance Range[c] (cd/m²)	Luminance Contrast	Mean Letter Luminance[d] (cd/m²)	Mean Background Luminance[d] (cd/m²)	Critical Distance (ft)
0.98	100	43–180	2	1–4	0.63	3.2	0.12	31
0.98	77	32–143	1.5	0.9–3.3	0.63	2.4	0.90	30
0.99	35	15.3–176	<1	<1	0.64	1.08	0.39	26
0.94	24	10.4–107	1	1–2	0.60	0.78	0.31	23
0.99	19.7	7.5–54	<0.3	<0.6	0.68	0.58	0.18	22
0.98	10.6	4.2–25	0.2	0.1–0.4	0.68	0.32	0.10	19
>0.99	14.2	5.1–32	<0.1	<0.2	0.66	0.42	0.14	21
>0.99	40	25–65	<1	<1	0.66	1.19	0.40	26
>0.99	8.7	5–15.7	<0.1	<0.1	0.67	0.25	0.08	18
>0.99	480	96–3400	<10	<10	0.69	14.6	0.45	38
>0.99	460	90–2900	<10	<10	0.68	14.2	0.45	38
0.99	2.8	1.41–5.0	<0.1	<0.1	0.61	0.1	0.036	13
>0.99	21	14.3–38	<1	<1	0.68	0.60	0.19	22

[c] Measurement is taken at the same time and resolution as letter luminance measurements, and data are reported to the same number of decimal places.

[d] Results of simulations are reported with the same number of significant digits as the corresponding measured values.

The National Lighting Product Information Program

The National Lighting Product Information Program (NLPIP) was established in 1990 and is administered by the Lighting Research Center at Rensselaer Polytechnic Institute. The Lighting Research Center is a nonprofit educational and research organization dedicated to the advancement of lighting knowledge.

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Lighting Research Center
Rensselaer Polytechnic Institute
Troy, NY 12180-3590
Phone: (518) 276-8716
Fax: (518) 276-2999
Internet e-mail: lrc@rpi.edu
World Wide Web:
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