Lighting Ready Reference

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1. The Law

A. NFPA 70 National Electrical Code (NEC)

- Intrinsically Safe Approval Classifications are needed so workers can identify what special equipment will be needed in certain flammable or explosive environments (hazardous locations). These locations are grouped according to the properties of the flammable materials that may be present and the likelihood of flammable concentrations.
- This standard can apply to flashlights or any electrically supplied equipment that may be used in a hazardous location
- All intrinsically safe equipment is required to carry a label that lists the hazardous locations for which it has been tested. If it doesn't say it on the label, it's not approved. These approvals do have specific temperature codes assessed to them.
- **The Three NEC Classifications for Hazardous Locations are**:
  - **Class I –** Locations where there is danger of explosion due to flammable gases or vapors present in quantities sufficient to produce explosive or ignitable mixtures.
  - **Class II –** Locations where there is a danger of explosion due to the presence of combustible or electrically conductive dust.
  - **Class III –** Locations where there is a danger of explosion or flash fire due to the presence of easily ignitable fibers or flyings.
- Division refers to the likelihood that ignitable concentrations of flammable materials are present:
  - **Division 1 –** Locations where the gases, vapors, conductive dust, flyings, and/or fibers are present in the air in potentially flammable concentrations continuously, frequently, or intermittently under normal conditions.
  - **Division 2 –** Locations where the gases, vapors, conductive dust, combustible dust, flying, and/or fibers might become hazardous in the event of mechanical breakdown, accident, failure, or the abnormal operation of equipment.

B. NFPA and OSHA Regulations for Emergency and Exit Lights

- NFPA states that exits or routes leading to exits must be marked by an approved sign readily visible from any direction. Signs must be distinctive and illuminated, letters must be at least 6" high, with the principal strokes of the letters in the word EXIT not less than ¾" wide.
- OSHA 29 CFR 1910 37 (b)(4) states that if direction of the exit is not immediately apparent, signs must be posted along the exit access indicating the direction of travel to the nearest exit. A light on the exit sign must clearly be visible at all times.
- OSHA 29 CFR 1910 37(b)(6) states each exit light must be illuminated to a surface value of at least 5' candles (54 lux) by a reliable light source and be distinctive in color. Self-luminous or electroluminescent signs that have a minimum luminance surface value of at least .06 footlamberts are permitted.
- 29 CFR 1910 37(b)(7) states each exit sign must have the word EXIT in plainly legible letters not less than 6" high with the principal strokes of the letters not less than ¾" in width.

2. The Essentials

A. What Are the Methods for Measuring Light?

- All light measurements can be traced back to the candela, which is the unit of luminous intensity. Candela is also sometimes called candlepower.
- There are two basic methods used by various flashlight manufacturers to rate the light output of their products:
- **Lumens** – The measure of the total amount of light from a given source. Not the actual brightness since the total light output is unfocused
- **Candela** – The power emitted by a light source in a particular direction. 1 candela = 1 "standard candle"

Candela is more important than lumens in a flashlight, lantern, etc., because candela is the actual measure of brightness in a focused beam. The lumen is a term referring to total light output, and is not a measure of the light when it is focused in one direction.

Comparing Lights Using Candela and Lumens - To compare candela versus lumens, it is always useful to understand that these are terms for entirely different properties of light. They do not mean the same thing. So, when shopping for a flashlight or lantern, you should consider the job the light will perform.

If the light's job is to illuminate a room, a field, or other wide areas, a higher lumen rating is the most desirable. If the light's job is to produce a beam that will penetrate fog or smoke, or to illuminate objects at a great distance, a higher candela rating is most important

B. What Are the Differences Between Incandescent and LED Flashlights?

Incandescent Bulbs

- Traditional flashlights use an incandescent bulb. The bulb is a thin wire, filament, enclosed inside a pressurized gas-filled glass.
- Light is created by heating the tiny wire inside the glass globe. There is only so much heating and cooling the wire can take and eventually it wears out and needs to be replaced.
- Only 4-6% of the electrical power generated in bulbs is converted to visible light.

LED (Light Emitting Diode) Bulbs

- LEDs use no filament and lose far less energy to heat. Diodes allow electric current to flow in one direction.
- The advantages of LEDs are:
  - **Energy Efficiency –** LEDs contain no filament. They lose far less energy to heat, and can produce light much more efficiently. In general, batteries used in LED-based flashlights last 5 times longer when compared to traditional flashlights, and they also operate more efficiently at low charge levels.
  - **Long Life –** LED bulbs have a life span of 100,000 hours. For incandescent bulbs to last 100,000 hours, you would have to replace the bulb over 100 times.
  - **Mechanical Reliability –** The components of an LED are cut from silicon chips and encased in a high-strength optical grade epoxy. With no glass or filament to break, LEDs are ideal for rugged environments and temperature extremes. Quality LEDs are very resistant to vibration and shock. Furthermore, LEDs can work well from -40 – 125°F.
  - **Safety –** LEDs produce very little heat, require little current, and are totally encapsulated. When installed into properly insulated housing products, they are safe to use near explosive gas or liquid.
  - **Economy –** Based on a power consumption savings ratio of approximately 1/5 for LEDs flashlight, total battery consumption costs could strongly favor the LEDs, if high usage is indicated
  - **Natural Light –** Most white LED flashlights emit light color similar to that of natural sun light

C. What Do I Need to Consider When Selecting a Flashlight?

Batteries

- The type, size, number, and quality of the batteries largely determine how powerful the light can be
- The battery determines how much the light output changes with time, during use, and how long the flashlight runs
- The battery also determines how the flashlight performs at low temperatures
- The battery largely determines the size and weight of the flashlight and its operating cost
- Types of batteries:
  - **Alkaline**
  - **Rechargeable**
    - Is offered in models where the batteries are charged internally
    - Some models can be charged by a computer or cell phone charge via a USB
  - **Lithium**
    - Can deliver over four times more power than alkaline, but are more expensive batteries

Configuration

- Flashlights come in any shape and size an end user can imagine. Most come with the ability to customize configurations to work as a hand held, hands-free, or mounted option.

Lamp or Light Source

- Incandescent bulb
- LED
- Halogen bulb

Refector or Lens

- The light produced by any light source in a flashlight is radiated in all directions. Either a reflector or a lens is needed to create a usable high-intensity beam.
- With incandescent bulbs, a reflector is the most efficient way to accomplish this
- With LEDs, a lens is most often used.

Spotlight or Floodlight

- **Spotlight –** By making the reflector or lens bigger, the resulting beam will be narrower and more intense
- **Floodlight –** By making the reflector or lens smaller, the resulting beam will be wider, its light intensity will decrease, and it covers a bigger area

D. What Are the Classes When Using Flashlights In Hazardous Locations?

- **Class I –** Areas in which flammable gases or vapors may be present in sufficient quantities to be explosive or ignitable. Typical Class I locations include:
  - Petroleum refineries and gasoline storage/dispensing areas
  - Industrial firms using flammable liquids in dip tanks or confined space locations
  - Petrochemical companies manufacturing chemicals from gas and oil
  - Dry cleaning plants where vapors from cleaning are present
  - Companies having spraying areas to coat products with paint or plastics
- **Class II –** Areas made hazardous by the presence of combustible dust. Typical Class II locations include:
  - Grain elevators, flour, and feed mills
  - Plants that manufacture, use or store magnesium, or aluminum powders
  - Producers of plastics, medicines, and fireworks
  - Producers of starch or candies
  - Spice grinding plants, sugar, and cocoa plants
  - Coal preparation plants and other carbon handling or processing areas
- **Class III –** Areas in which there are easily ignitable fibers or flyings present. Typical Class III locations include:
  - Textile mills, cotton gins, cotton seed mills, and flax processing plants

- Clothing and manufacturing plants
- Any plant that shapes, pulverizes, or cuts wood and creates saw dust or flyings

E. What Are the Basics of Exit Signs?

- All exit signs need to provide light for 1½ hours after a power failure has occurred in order to get everyone safely out of the facility. The customer should test them once a year.
- If non-powered exit signs are used you are required to have this area illuminated. This implies needing emergency lights in this immediate area in case of power failure.
- Sign color is not a major factor for visibility. Our electrically powered exit signs normally come with both red and green panels.
- We offer signs with either incandescent or LED bulbs
- Exit signs with additional lights are designed to provide extra lighting in dark areas and directional support to the exit
- Electrically powered exit signs are sold in two primary styles:
  - **Exit Sign –** This is hard wired into the building. If there is a power outage, this sign will not stay lit. When not accompanied by emergency lighting with rechargeable batteries, this exit sign will not meet the life safety code requirements.
  - **Emergency Exit Sign –** These signs are also hard wired into the building. If there is a power outage, this sign has a battery backup that will illuminate the sign when it senses no charge going to the battery.
- **Photoluminescent Exit Sign –** This is a non-electrical sign that glows in the dark. This is a legal exit sign to use without floodlights on it, once it has been determined that a minimum of 54 lux of fluorescent light is on the face of the sign at all times during building occupancy. This sign is a great idea for new construction or newly designated exit routes, as no wiring is needed.

F. What Are the Basics of Emergency Lights?

- These lights use rechargable batteries that are constantly being charged while the power is on
- In the event of a power failure, the rechargeable batteries will kick in and provide light to exit areas
- The Streamlight Power Failure System is unique in that it can be pulled off the wall station and used as a handheld floodlight to assist with getting employees out of a building

G. What Are the Options for Vehicle Lighting?

- Permanent mount lighting is hard wired into the vehicle's electrical system
- Magnetic mount lighting is designed to be temporary and is plugged into the cigarette lighter

3. Product Reference

A. Batteries
B. Replaecement Bulbs
C. Safety Vests – For those ordering vehicle lights
E. Snaplight Lightsticks – For quick emergency lighting
F. Exit Signs