



TEAMSTERS Safety & Health FACTS

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Lighting (Illumination) in Warehouses

Importance of Lighting

Workers at a warehouse need to spot oncoming vehicles, pedestrians, slippery floors and other hazards in time to prevent injuries and accidents. Areas of the warehouse that require lighting include the loading dock, shipping and receiving areas, open storage areas, and rack storage. There are four types of lighting commonly seen at warehouses: Fluorescent (white); Metal Halides (bluish white); High Pressure Sodium (emits amber/golden light); Natural Light (e.g. skylights).

Poor lighting can include a range of problems such as:

- ◆ Insufficient light - not enough light for the need
- ◆ Glare - too much light for the need
- ◆ Improper contrast
- ◆ Poorly distributed light
- ◆ Flicker

In general, lighting is important in the work environment for the following reasons:

- ◆ Efficient and accurate performance of visual tasks; 80% of information about surroundings is processed through the eyes
- ◆ Worker safety and health
- ◆ Capital expense and maintenance costs
- ◆ Productivity
- ◆ General feeling of well-being

Poor lighting can adversely affect the safety and health of workers by contributing to:

- ◆ Eye/visual fatigue (vision diminishes with age)
- ◆ General stress and strain (headaches, etc.)

- ◆ Changes to the sleep-wake cycle¹
- ◆ Poor psychological health, morale
- ◆ Increased possibility of errors
- ◆ Increased probability of accidents by misjudging the position, shape or speed of an object

Lighting Quantity and Quality

The quantity of light can be measured through the use of a light meter at the point and in the plane (horizontal or vertical) that the task is performed. The quantity of light in the vertical plane (as opposed to horizontal) is important when items are stored on stacks. Lighting levels are measured in lux (lumens per square meter) or footcandles (fc) (lumens per square foot).

“While a lighting survey can be conducted to evaluate the effectiveness of illumination, interviews may also be necessary to determine the existence of a safety or health problem [that may be related to poor lighting]. Interviews should solicit signs and symptoms such as eye fatigue, eye strain, headaches and a history of safety problems such as incidences of falling, tripping, or bumping.”²

Besides its quantity, lighting should also be evaluated in terms of its quality, i.e., freedom from glare, shadows, extreme contrasts, correct direction, distribution, and visual fatigue.

Supplementary luminaires would be appropriate in places where tasks, such as loading into a trailer, may require more lighting than that which is consistently and permanently provided. “The supplementary light should be adjustable to direct light where it is needed and to minimize glare.”³

Maintenance Programs

A comprehensive lighting maintenance program should be instituted and carried out at a warehouse on a regular basis to address the following:

- ◆ illumination levels;
- ◆ repair and replacement of lamps and components; and
- ◆ renewal and cleaning of wall, ceiling and work surface finishes.

Proper maintenance would reduce deterioration of equipment; promote safety; keep lighting performance within design limits; and reduce electrical load and capital costs. Employers should maintain minimum illumination levels to ensure safe working conditions, safe passage, and the identification of hazards or obstructions. Since light output decreases over time as lamps age and as dirt accumulates on luminaires, windows, ceilings, walls and other room surfaces, higher

¹ “Scientists have long known that light plays an important role in regulating the human body’s daily biological rhythms—also known as circadian rhythms—including the sleep-wake cycle, alertness, and hormone production.” LRC studies human response to light, discovers evidence of mechanism leading to melatonin suppression. Lighting Research Center. <http://www.lrc.rpi.edu/resources/news/enews/apr04/generalnews.html>

²Ibid.

³ *Design Guide for Warehouse Lighting (DG-2)*. The Illuminating Engineering Society of North America. 1992.

initial levels could be used to compensate for their depreciation and maintenance should be performed to reduce these effects.

“Dark surfaces absorb light and light-colored surfaces reflect light. White paint reflects about 80% of the light that strikes it, while concrete or wood may reflect only 20-40%...The simple step of specifying light-colored ceiling surfaces and structural elements will vastly improve both lighting efficiency and lighting quality.”⁴

Technical, Federal and State Standards

The Illuminating Engineering Society of North America (IESNA), a technical organization that develops recommendations for lighting, addresses the lighting requirements of warehouses and storage areas in its *Design Guide for Warehouse Lighting (DG 2-92)*. A new system called the *IESNA Lighting Design Guide* was introduced in the *IESNA Lighting Handbook*, 9th Edition, published in 2000. The *Design Guide for Warehouses* is under revision to track the methods presented in the Handbook.

Appropriate light levels depend on type of work and a variety of characteristics of the work environment. The following chart gives lighting levels recommended by IESNA *Lighting Handbook* for warehouses depending on the level of activity and the size of the labels. The activity involves identifying and selecting a variety of large to small items – moving them on and off shelving, pallets or other storage racks. Labels may be used to mark aisle locations or placed on the stored items for coding purposes. Reading information on the labels is one task; some labels may use color coding for identification.

Warehousing and Storage:

Level and type of activity in the space	Recommended lux (lx) or footcandles (fc)
Inactive or infrequent use	50 lx or 5 footcandles (fc)
Active or regular use: bulky items; large labels	100 lx or 10 footcandles (fc)
Active: small items; small labels	300 lx or 30 footcandles (fc)

The federal Occupational Safety and Health Administration’s (OSHA) does not have a general standard for normal ambient lighting. However, OSHA’s standard on *Maintenance, safeguards, and operational features for exit routes* (29 CFR 1910.37) specifies that “Each exit route must be adequately lighted so that an employee with normal vision can see along the exit route” and “in proper working order at all times.” In addition, OSHA’s standard on *Powered Industrial Trucks* (29 CFR 1910.178) contains safety requirements for the use of fork trucks, tractors, platform lift trucks, motorized hand trucks, and other specialized industrial trucks powered by electric motors

⁴ *Warehouse Skylighting, Knowhow Series*. Design Lights Consortium (DLC).
http://www.designlights.org/downloads/skylighting_Warehouse.pdf

or internal combustion engines. Section (h)(2) states “Where general lighting is less than 2 lumens per square foot, auxiliary directional lighting shall be provided on the truck.”

In the construction industry, OSHA’s standard on *Illumination* (29 CFR 1926.56) specifies 5 footcandles as the minimum illumination intensity for construction material warehouses while any work is in progress.

Some states have adopted specific standards for illumination in workplaces. The California standard on *Illumination* (Title 8, Section 3317) states that:

- ◆ “The working areas, stairways, aisles, passageways, work benches and machines shall be provided with either natural or artificial illumination which is adequate and suitable to provide a reasonably safe place of employment.” [Section a]
- ◆ “When adequate natural illumination or permanent artificial illumination cannot be made available to secure the safety of employees, suitable portable lights shall be provided.” [Section b]
- ◆ “Skylights, side windows, lamps, and other light accessories which provide necessary illumination shall be kept sufficiently clean, adjusted, and repaired so as not to impair the illumination required for the safety of employees.” [Section c]

Important Definitions

Contrast is the relationship between the brightness of an object and its background. The greater the contrast of an object with its background, the higher its visibility. Up to a point, higher levels of illumination may compensate for poor contrast.

Flicker refers to quick, repeated changes in light intensity - light that appears to flutter and be unsteady. Although humans cannot see fluorescent lights flicker, the sensory system in some individuals can detect the flicker.

Glare is any reflected brightness (from a surface or unshielded light source) that interferes with visual performance and visibility and may be accompanied by discomfort. Glare may limit a person’s ability to perform a task (disability glare) safely and accurately.

Illuminance is the amount of light falling on a surface. The units of measurement are lux and footcandles. A light meter is used to measure it.

Footcandle (fc) is an IP (inch-pound) unit of illuminance or illumination received by a surface at a distance of one foot from a source of intensity (1 footcandle=1 lumen/square foot).

Lumen is the most common measurement of light output from a lamp. The lumen output of a lamp depends on the lamp type and its wattage. As lamps and fixtures age and become dirty, their lumen output decreases.

Luminaire is a complete lighting unit, often referred to as a “light fixture.” A luminaire consists of the lamp, optical reflector and housing, and electrical components for safely stating and operating the lamp.

Lux is the SI (International System or metric) unit of illuminance received by a one square meter surface one meter from a source of intensity (1 lux=1 lumen/square meter). One lux is equal to approximately 0.09290 footcandles.

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