

SSPC: The Society for Protective Coatings

TECHNOLOGY GUIDE NO. 12

Guide for Illumination of Industrial Painting Projects

1. Scope

1.1 This guide provides information on the quantity and quality of lighting on industrial painting projects that is conducive to achieving quality surface preparation and coating application, productivity, inspection/quality control, and accident prevention.

1.2 This guide is intended for use by facility owners, specifiers, designers, and contractors.

2. Background

2.1 Lighting standards have been established for most industrial applications by the American National Standards Institute (ANSI). One standard addresses the temporary lighting conditions common to most industrial painting projects. ANSI Z117.1, "Safety Requirements for Working in Tanks and Other Confined Spaces," establishes minimum requirements for safe entry, continued work in, and exit from tanks and other confined spaces. The ANSI standard sets entry procedures which include the use of a permit to authorize illumination of the space. No specific criteria on illumination are stated.

2.2 Adequate illumination improves productivity and motivation while poor illumination increases the risk of accidents and costs of operation. Additional illumination beyond recommended levels may be beneficial but not essential to achieving these objectives. In addition, unnecessarily high lighting levels add to the cost of procurement, installation, and maintenance and may have a negative impact on safety and productivity due to increased glare. Light with substantial color bias, regardless of foot candles, can hinder the observation of the true condition of the work surface.

2.3 While natural lighting or use of white containment materials may provide adequate levels of illumination, once the decision to use artificial lighting to illuminate a work area is made, portions of the National Fire Protection Association (NFPA) and Occupational Safety and Health Administration (OSHA) regulations on portable lamps and wiring installation have direct application. However, an integrated guide specific to the coatings industry is necessary to help establish minimum standards on quality and quantity of light, as well as consolidate applicable electrical hazard controls.

2.4 Refer to any and all appropriate sections which pertain to portable lamps: NFPA 70, "National Electric Code" and OSHA regulations 29 CFR Sections 1926.402-408.

2.5 The recommended levels of illumination contained in this guide are a result of both objective and subjective examination of lighting conditions in a variety of work spaces: tanks, containments, blast and paint rooms, shop floors, and other situations where similar conditions exist. The resulting lighting recommendations are believed to be comfortable for the workers, contributing to distortion-free work surfaces and adequate levels of illumination for performing general surface preparation, painting and inspection activities in the work space. Natural lighting, artificial lighting, or a combination of the two may be used to achieve the levels specified in this guide.

3. Referenced Standards

3.1 AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) STANDARDS:

RP7	Practice for Industrial Lighting
Z117.1	Safety Requirements for Confined Spaces

3.2 FEDERAL SPECIFICATIONS AND STANDARDS:

Code of Federal Regulations Title 29, Chapter XVII, Occupational Safety and Health Administration (OSHA):

Part 1910	Occupational Safety and Health Standards, Subpart J--General Environmental Controls
29 CFR 1910.146	Permit-required confined spaces
29 CFR 1926.402	Part 1926--Safety and Health Regulations for Construction, Subpart K- Electrical, Installation Safety Requirements
29 CFR 1926.403	Applicability
29 CFR 1926.404	General requirements
29 CFR 1926.405	Wiring design and protection
29 CFR 1926.406	Wiring methods, components, and equipment for general use
29 CFR 1926.407	Specific purpose equipment and installation
29 CFR 1926.408	Hazardous (classified) locations
29 CFR 1926.409	Special systems
29 CFR 1926.449	Definitions applicable to Subpart K --Electrical

3.3 NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) STANDARDS:

70	National Electric Code
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3.4 UNDERWRITERS' LABORATORIES (UL) STANDARDS, ANSI APPROVED:

298	Standard for Portable Electric Hand Lamps
1598	Standard for Luminaries (replaces all below)

4. Definitions

Confined space: Per 29 CFR 1910.146, a confined space is a space that: (1) is large enough and so configured that an employee can bodily enter and perform assigned work; and (2) has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry); and (3) is not designed for continuous occupancy.

Foot candles: A unit of illumination; the illumination at a point on a surface which is one foot from, and perpendicular to, a uniform point source of one candle.

General work area lighting: The level of illumination throughout a work area, measured at various locations on the horizontal work plane, at least six feet from the nearest light source.

Non-permit required confined space: A confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical injury.

Permit required confined space: A confined space that has one or more of the following characteristics: (1) contains or has the potential to contain a hazardous atmosphere; (2) contains a material that has the potential for engulfing an entrant; (3) has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or (4) contains any other recognized safety or health hazard.

Task-specific lighting: The level of illumination required for performing specific visual tasks (e.g., inspection).

White light: Light containing all wavelengths in the visible range at similar intensity.

5. General Conditions

5.1 MONITORING STRATEGY

5.1.1 Quantity of Existing (Natural) Light: Some natural light will be present in most work areas during daylight hours and the color of any containment materials (e.g., white tarps) may improve natural light. The amount of natural light will depend on factors such as time of year, time of day, orientation of the work area, and prevailing weather conditions. Although it is not likely that the quantity and quality of natural light will be sufficient for work in most confined spaces, the amount of additional lighting necessary to meet the recommendations of this guide will be affected by the amount of ambient natural light available. Measurements should be made with a light meter held at or placed on the surface. With the sensor aligned

perpendicular to the surface, make a minimum of five measurements which are representative of the work area. Record each and calculate the average of the measurements.

5.1.2 Effect of Airborne Dust: Airborne dust will reduce visibility. Consideration must be given to the amount of loose debris which may be created during paint removal or application operations. Depending on the expected concentration of airborne dust, provisions may be required for its removal prior to the start of work in order for adequate illumination to be achieved.

5.2 CLASSIFICATION OF LOCATIONS: Once the evaluation of the work area is complete the work locations should be classified as one of the following:

5.2.1 Hazardous locations where the potential for explosion and/or fire exists. Hazardous locations are defined as those locations where quantities of flammable gases or vapors, explosives, combustible dusts, fibers, or flyings are present or likely to become present. Lighting fixtures used in hazardous locations must be explosion proof and Underwriters Laboratory or Factory Mutual approved for use in the appropriate Class and Division atmosphere.

See Appendix A for a discussion of hazardous locations.

5.2.2 Non-Hazardous locations where the potential for explosion and/or fire does not exist. Lighting fixtures used in nonhazardous locations must be designed to UL Standard 298.

5.2.3 Wet locations where installations are underground or in concrete slabs or masonry in direct contact with the earth, and locations subject to saturation with water or other liquids, such as unprotected locations exposed to weather.

Lighting fixtures used in wet locations must be designed to UL 1598.

6. Illumination Requirements

6.1 A light meter with readings in foot candles should be used to verify the adequacy of the illumination. For general work area measurements, the meter should be placed on a horizontal plane parallel with the work surface (e.g., walking across staging). For task specific measurements, the meter should be held at, or placed on, the surface, with the sensor aligned perpendicular to the surface. Make a minimum of five measurements representative of the work area or task. Compare the average to the criteria in Table 1 and Table 2.

7. Recommendations

The recommendations below are applicable for any artificial lighting required to achieve adequate illumination of a given work area or specific task.

