

INDUSTRIAL BUILDINGS AND PLANT LAYOUT

Types of lighting

Natural lighting. Daylight is an ideal type of illumination. However, light from overhead diagonal windows causes less glare than that from outside windows only. When practicable, existing sawtooth, monitor, or skylight windows can be fitted with refracting, diffusing, or tinted glass to reduce intensity and thus alter the characteristics and improve the distribution of daylight, particularly from distant parts of the room.

For most effective use of daylight, a definite floor/window area relationship must be maintained.* A single-story industrial building should have a window area equal to not less than 30 per cent of the floor area.

Reflection of daylight from surfaces outside the building should be utilized. Light colors should be used for exteriors of structures, walls of courts, and roofs of sawtooth buildings. For best reflection, these surfaces must be kept bright. Windows, too, must be kept clean.

Sudden transitions from brightly lighted to dim areas—and vice versa—are dangerous; the result is momentary blindness due to the lag in eye accommodation. Gradations of light between areas of different intensities will remedy this difficulty. Venetian blinds, shades, or drapes can be used to balance daylight and reduce glare.

Artificial lighting has become so accepted as an element of modern life that its original supplementary character has been largely forgotten. Artificial lighting has become the major source of illumination because natural light is undependable, especially in the winter when work schedules do not coincide with daylight.

For continuous shift operation artificial light is essential. For other types of operation, it must be relied upon from 20 to 50 per cent of the total working hours, excluding overtime work or night work.

General lighting is the base or minimum amount of light required. It has been defined as uniform distribution of light to produce equivalent seeing conditions throughout an interior. This is the type most commonly used for large general offices, schoolrooms, factories, and similar interiors.

Localized general lighting sources usually are arranged 10 ft or more above the work to prevent too great a contrast in

brightness between the more highly lighted work area and the adjacent areas and to provide sufficient light for general safety and for ordinary visual needs.

Light intensity on a surface varies inversely with the square of the distance between the surface and the source of the light. A source 10 ft above a surface would give four times more light to the work area than would the same source 20 ft high. Where visual needs are more critical, therefore, additional lighting can be provided by fixtures placed fairly close to the area needing more light.

Standards

Lighting requirements for industrial operations vary considerably. A table of minimum standards of illumination for industrial interiors as recommended by the Illuminating Engineering Society is given in Chapter 45, "Safety Engineering Tables."

A convenient device for measuring illumination is a light meter. This gives a direct reading of the number of footcandles of light reaching the work surface.

Lighting requirements are determined by a visibility meter, which gives a direct reading of the number of footcandles required to see the task being studied as compared to a selected standard task. The relative ease of seeing objects that vary in shape, size, and detail can be evaluated. The direction of light and the degree of diffusion required for maximum visibility also can be determined.

Glare

Care must be taken throughout the lighting system to avoid glare. Glare has been described as "any brightness within the field of vision of such character as to cause discomfort, annoyance, interference with vision, or eye fatigue."¹ It may be direct or reflected.

Direct glare causes visual discomfort because the sensitivity of the eye is disturbed, whereas reflected glare interferes with visi-

*Illuminating Engineering Society, 1860 Broadway, New York City. *Daylighting, Lighting Handbook*

¹*Ibid* Glare and Lighting Design