

area cleaning at least twice per year is recommended,⁵⁹ but this varies widely depending on the rate of dirt accumulation and the type of lighting system installed. Figure 28 shows some typical conditions.

Relamping is done either on an individual replacement basis or on a group replacement plan.^{55,60} With the consistent lamp life characteristic of present-day sources, the group replacement plan is usually the more economical. Lamps are replaced at 70 to 80 per cent rated life, and the few burnouts between replacement schedules can be replaced individually with the best of the operable lamps from the previous group. Group relamping may be done during a cleaning operation to further cut costs. Under the group relamping plan the small additional cost of lamps is offset by the reduction in labor cost of doing the job on a mass-production basis.

X. Supplementary Lighting

In many applications the general lighting system alone is not sufficient, and some kind of supplementary lighting⁶¹⁻⁶³ is necessary (Figure 29). It must be kept in mind that supplementary lighting is just what the word implies—lighting that supplements the general lighting system. A good general lighting system is still necessary to provide an over-all comfortable seeing environment. Where the object or task is small in size or has little contrast with its immediate background, an additional quantity of light supplied by a supplementary system increases the worker's seeing ability. For these tasks a well-shielded source directed at the work is employed.

Directional lighting is often used for detecting scratches, pits, and surface flaws on nonspecular materials (Figure 30). For this purpose a beam of light provided by narrow-beam reflectors, lenses, or spot lamps is directed at a grazing angle across the surface of the material being inspected. Defects will show up as highlights or shadows. This method may sometimes be used also on specular materials. The surface to be inspected appears dark to the operator, except for imperfections, which appear bright because they reflect light. One must be particularly careful to control the directional beam of light so that it is shielded from the operator's eyes and from other persons.

A third technique employs a diffuse light source, generally large in area and

⁵⁹ C. E. Egeler and R. F. VandenBoom, Maintenance of industrial lighting—Part 2, *Illum. Eng.*, 48, 631 (1953).

⁶⁰ Lighting maintenance—group relamping, *Bulletin LS-155*, Lamp Division, General Electric Co., December, 1953.

⁶¹ Recommended practice for supplementary lighting (Prepared by the Subcommittee on Supplementary Lighting of the Committee on Lighting Study Projects in Industry of the Illuminating Engineering Society), *Illum. Eng.*, 47, 623 (1952).

⁶² C. M. Cutler and E. A. Lindsay, Supplementary lighting, *Magazine of Light*, 20, 10 (November, 1951).

⁶³ E. A. Lindsay, Specialized lighting for inspection and control, *Ind. Quality Control*, 11, 357 (1954).



Figure 29. Supplementary lighting provided by adjustable units near the task, which contain two 15-watt fluorescent lamps. A good general lighting system is necessary to provide balanced brightness and a comfortable surround.

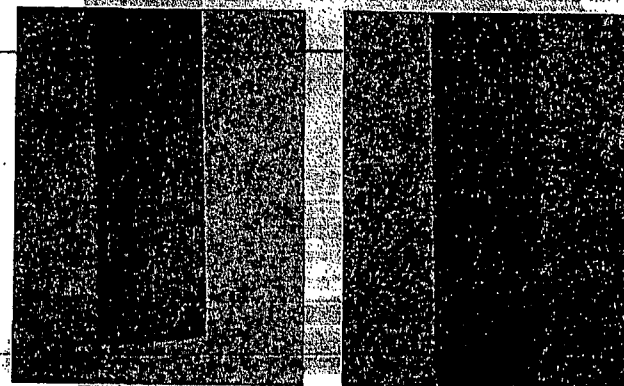


Figure 30. Rough surface on an unsanded Venetian blind slat (right) is easily detected with a beam of light directed at a grazing angle across the surface. Under diffused light (left), surface roughness is not as apparent.

uniform in brightness, for illuminating the material to be inspected. (Figures 31 and 32). It may also be used for transilluminating materials such as photographic negatives, bottles, and fabrics for inspection purposes (Figure 33). Diffused sources with a pattern of lines painted on the translucent panel are used to detect