

Lighting in the Workplace

The quality of lighting in a workplace can have a significant effect on productivity. With adequate lighting workers can produce more products with fewer mistakes, which can lead to a 10-50 % increase in productivity. Good lighting can decrease errors by 30-60 % as well as decrease eye-strain and the headaches, nausea, and neck pain which often accompany eye-strain. Adequate lighting allows workers to concentrate better on their work which increases productivity.

The level of lighting that workers need varies depending on the nature of the task, the sharpness of the workers' eyesight, and the environment in which the work is done. For example, detailed work, such as inspection, assembling of small parts or technical drawing, needs a great deal of light. Coarse work, on the other hand, such as loading or unloading materials, handling of materials or packaging, requires less light.

Good lighting in the workplace promotes:

1. a reduced risk of occupational accidents and health problems;
2. better concentration and accuracy in work;
3. a brighter, cleaner workplace resulting in a more active, cheerful environment;
4. improved work performance;
5. better visibility, improved accuracy and increased work speed enhancing production.

It can be easy to improve lighting without increasing the number of light bulbs, light fixtures or the electric bill. Improved lighting can be achieved by using more daylight, by changing the position of light sources or workstation layouts and by effectively using reflected light. Consider the following guidelines when planning to improve the lighting conditions in your workplace:

1. determine the problem:
 - i. talk to workers and find out if they suffer from headaches, neck pain, or nausea, all of which may be caused by eye-strain. Ask if they have difficulty seeing their work. It is essential to implement safety activities with the workers' full cooperation as they might have very positive ideas for improving safety and productivity. The worker doing the job can best evaluate the impact of a change;
 - ii. see for yourself if there are any obvious lighting problems. If workers have their eyes unnaturally close to the object they are working on, it is likely there is a problem, or if workers feel there is a need to make extra efforts to make out details when it is cloudy, rainy or at certain times of the day;
1. consider alternative solutions which are best adapted to the company's capacities. Take these into consideration before implementing an improvement;
2. get advice and observe a similar improvement under similar conditions in another enterprise or workplace;
3. make small but continuous improvements by trying out the idea first on a small-scale to see how it works;
4. consider quick implementation of ideas that can be put into practice immediately to demonstrate positive change.

Here are some low-cost measures which promote a safe working environment, reduce the workload and increase productivity. These measures are easy to implement in small and medium-sized enterprises.

Make Full Use of Daylight

Natural lighting is most effective in improving illumination. Using daylight improves morale and it is free. Examine the workplace layout, material flow and workers' needs, then try out these tips on how to make good use of daylight:

1. provide skylights, for example by replacing roof panels with translucent ones;
2. equip the workplace with additional windows;
3. place machines near windows;
4. move work requiring more light near windows.

Consider the following before planning and installing windows and skylights:

1. consider the height, width and position needed for windows or skylights. More light is available when the window is placed high on a wall;
2. install shades, screens, louvers, canopies or curtains on the windows and skylights to protect the workplace from external heat and cold while taking advantage of the natural light;s
3. orient skylights and windows away from direct sunlight to obtain constant but less bright light;
4. direct skylights and windows towards the sun if variations in levels of brightness throughout the day do not disturb workers;
5. avoid storage or placement of flammable liquids in direct sunlight as the magnification of the sun's heat may lead to vaporization of the liquid and increase the risk of fire.

Use Local Light

The use of local light has many advantages. Local lighting requires less power to get adequate brightness since brightness is decreased exponentially by the distance from a light source. Here are some suggestions for maximizing the use of local lighting:

1. place and direct light the way it seems best for the work being performed;
2. light up the spot where light is needed;
3. use mobile stands or flexible arms to enable directing light where it is needed;
4. select the correct direction of the light to prevent annoying shadows and glare;
5. the effects of different directions of lighting are as follows:
 - i. lighting from the back of an object helps to distinguish it from its background;
 - ii. lighting coming from an upper angle clearly reveals the shape and surface texture;
 - iii. direct lighting from the front may clearly reveal surface markings but the ability to see texture is reduced;
6. add or take away local lighting as necessary to obtain the optimum level of lighting;
7. combine general and local lighting by providing the minimum required light with general lighting and adjust lighting levels at specific locations using local lighting.

Paint Ceilings and Walls in a Light Colour

Light colours create more reflection than dark colours. Light colours make it easier to keep ceilings and walls clean. Glossy white painted surfaces reflect 100% of the light whereas black surfaces reflect no light at all. To achieve improved illumination, follow these recommendations:

1. use white or a very light colour on ceilings;
2. paint walls white;
3. use light or half-tone colours on tables and machines.

Choose an Appropriate Background

The background at the workstation is important, especially for visual tasks that demand close, continuous attention. A simple background will allow for more accuracy and an increase in production whereas a complex background may disturb the work and increase the workload. To obtain an optimum visual task background:

1. eliminate potential sources of distraction, such as posted papers, forms or schedules on walls;
2. use light-coloured partitions and screens to eliminate or screen sources of distraction;
3. select an appropriate colour for the work background. The following table provides some guidance for making the selection:

| Material | Appropriate background colour |
|---------------------|--------------------------------------|
| steel, cast iron | cream coloured |
| bronze, copper | grey-blue |
| light-coloured wood | dark |
| aluminium, tin | cream coloured |
| dark wood | grey-blue |
| ground castings | light |

Eliminate Shadows and Glare

Shadows and direct or indirect glare reduce lighting, make it difficult to work and decrease productivity. Glare is usually caused by light from lamps, skylights and windows. Here are some low-cost suggestions to eliminate shadows and glare:

1. change the position of light sources;
2. change the position of the workstation;
3. use multiple light sources by mixing direct and reflected light;
4. use lamp shades which reflect light upwards, since reflected light from ceilings provides the best visibility;
5. provide lamp shades with a white inside and black inside-edges;
6. use lamps with a movable stand or a flexible arm to easily change the direction of light;

7. use a magnetic lamp stand with a clip to easily change the position of the lamp;
8. hang lamps high and use light sources with a relatively large surface area such as fluorescent lamps to obtain even general lighting with less glare;
9. construct skylights and windows on the non-sunny side to obtain an evenly lit working area;
10. provide blinds, curtains, louvers, trees and vines to shade the building;
11. use matte paint or darker colours for all surfaces (for example, tables, machines, tools);
12. install screens, covers or partitions for shielding strong light which produces glare;
13. combine daylight from windows and skylights with ceiling and local lights to reduce sharp shadows and glares and to achieve optimum lighting conditions.

Provide Separate Electric Switches

Separate and individual electrical switches allow workers to switch off unnecessary lamps resulting in considerable savings on electricity. Consider these tips:

1. supply separate and individual switches for each general lighting fixture and for local lights or a group of lamps;
2. install switches within easy reach of workers;
3. install switches which are easy to operate;
4. assure that each local light has its own plug allowing it to be easily moved according to work requirements;
5. provide an individual plug and socket at the workstation to reduce the need for extension cords and reduce the potential for having entangled wires which can result in dangerous situations.

Maintenance of Lighting

Periodic maintenance is important for productivity and cost-savings. Lamps give off less brightness when they are dirty but still consume the same amount of electricity. If lamps, skylights, windows, ceilings, walls and work areas are maintained in good condition, lighting can be improved without increasing the number of fixtures or light bulbs. In a dusty workplace, light coming from windows is reduced 30-40% after three months and 45-55% after 6 months. Therefore it is important to:

1. clean all the essential elements in workplace at regular intervals;
2. replace light bulbs and tubes which have blown or are reduced in brightness;
3. place light bulbs which have reduced in brightness at another workstation where less light is required;
4. use open top type lamp shades to prevent dust from collecting on light bulbs and tubes.

Checklist For Productive Lighting

How to use the checklist

1. Ask the manager any questions you have. You should learn about the main products and production methods, the number of workers (male and female), the hours of work (including breaks and overtime) and any important labour problems.
2. Define the work area to be checked. In the case of a small enterprise the whole production area can be checked. In the case of a larger enterprise, particular work areas can be defined for separate checking.
3. Read through the checklist and spend a few minutes walking around the work area before starting to check.
4. Read each item carefully. Look for a way to apply the measure. If necessary, ask the manager or workers questions. If the measure has already been applied or it is not needed, mark NO under "Do you propose action?" If you think the measure would be worth while, mark YES. Use the space under REMARKS to put a description of your suggestion or its location.
5. After you have finished, look again at the items you have marked YES. Choose a few where the benefits seem likely to be the most important. Mark PRIORITY for these items.
6. Before finishing, make sure that for each item you have marked either NO or YES, and that for some items marked YES you have marked PRIORITY.

PRODUCTIVE LIGHTING

1. Skylights or windows are used to take advantage of day light.
Do you propose action?
Yes No Priority
Remarks _____
2. Workstations are arranged so that work requiring strong light is done near windows or under skylights.
Do you propose action?
Yes No Priority
Remarks _____
3. Ceilings and walls are painted white or in a light colour.
Do you propose action?
Yes No Priority
Remarks _____
4. Multiple light sources are used at workstations.
Do you propose action?
Yes No Priority
Remarks _____

- 5. Lamps, windows and workstations are positioned to prevent glare.
Do you propose action?
Yes No Priority
Remarks _____

- 6. Lighting fixtures are placed at a high position or lamp shades provided to prevent direct glare.
Do you propose action?
Yes No Priority
Remarks _____

- 7. Blinds, curtains, louvers, shades, trees and vines are used to prevent or diminish direct glare from the sun.
Do you propose action?
Yes No Priority
Remarks _____

- 8. Light sources, machines or other objects reflecting light are relocated to prevent indirect glare.
Do you propose action?
Yes No Priority
Remarks _____

- 9. Lamps are placed high to provide evenly distributed general lighting.
Do you propose action?
Yes No Priority
Remarks _____

- 10. Local lamps are used to provide adequate light required for detailed work.
Do you propose action?
Yes No Priority
Remarks _____

- 11. Moveable local lamps with flexible arms are provided.
Do you propose action?
Yes No Priority
Remarks _____

- 12. Direction of light sources is selected considering the type of task.
Do you propose action?
Yes No Priority
Remarks _____

- 13. General and local lighting are combined to provide necessary light and prevent large contrasts in brightness.
Do you propose action?
Yes No Priority
Remarks _____

14. Work is avoided in an isolated area of strong light surrounded by a poorly lit background

Do you propose action?

Yes No Priority

Remarks _____

15. Screens or curtains are used to avoid a complex background.

Do you propose action?

Yes No Priority

Remarks _____

16. Appropriate colours are used for work backgrounds.

Do you propose action?

Yes No Priority

Remarks _____

17. Light-coloured screens or partitions are used to improve visibility of objects.

Do you propose action?

Yes No Priority

Remarks _____

18. Each lamp or each group of lamps has its own electrical switch.

Do you propose action?

Yes No Priority

Remarks _____

19. Individual plugs and sockets are provided at workstations to reduce use of extension cords.

Do you propose action?

Yes No Priority

Remarks _____

20. Lamps, skylights, windows, ceilings, walls and partitions are cleaned periodically.

Do you propose action?

Yes No Priority

Remarks _____

21. Light bulbs and tubes which have blown or are reduced in brightness are replaced.

Do you propose action?

Yes No Priority

Remarks _____