



Research Article

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INVESTIGATION OF LIGHTING VALUES IN WEAVING BUSINESS IN TERMS OF OCCUPATIONAL HEALTH AND SAFETY

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ABSTRACT: The definition of Occupational Health and Safety terms with risk factor measurements becomes more important for companies. Collecting data on occupational accidents and occupational diseases is the first step to assessing conditions in some sectors. According to Occupational Health and Safety Law No. 6331, the employer is obliged to make a risk assessment in terms of occupational safety. In this context, it is not possible to evaluate the risk without measuring the physical and chemical risk factors. Therefore, environmental measurement studies should be carried out primarily in a company. In this study, a weaving mill was chosen. The results of these measurements were compared on a machine-by-machine basis. A total of 18 lighting measurements were carried out in the weaving.

Keywords: Lighting, Weaving, Safety, Exposure

1. INTRODUCTION

Lighting, which is light applications designed in accordance with visual perception of areas in the working environment, is one of the important elements in physical factors [1]. Lighting can be considered in three ways as physiological, decorative and striking lighting in terms of its purpose. The purpose of physiological lighting is to see objects in shape, color and details comfortably and quickly. As with any type of lighting, effects that may impair the eyesight of the eye and cause physiological disturbances should be avoided [2]. Lighting is one of the most important factors in providing a safe and healthy working environment in workplaces, making visual relations easily and creating the most appropriate field of view.

A suitable lighting ergonomics should primarily be such that the dangerous situation/behavior in the workplace is made visible. The most important and first principle of good lighting ergonomics is that it is adequate. Insufficient light level will have negative consequences on the physical and psychological health of the individual, as well as on safety and productivity [3]. Insufficient illuminance can be defined as less than the required illuminance level. When it comes to suitable lighting criteria in the working environment, how much light is required, that is, the level of illumination is the most important factor. By providing quickness and accuracy in vision with adequate lighting, time is saved and quality is improved. Insufficient lighting can

affect the quality of work, especially where sensitive work is done and general lighting is required. Too much or too little light can cause difficulties in seeing, as well as have negative consequences on the physical health and psychology of the employees, such as burning, headache, chronic visual disturbances. The textile industry has many sub-sectors. One of these sub-sectors is the weaving industry. While the weaving sector is so important, occupational safety activities in the sector should function flawlessly [4].

2. LIGHTING IN WEAVING BUSINESS

2.1. Lighting and Work Accidents

Lighting intensity and its distribution in the workplace have a great impact on how quickly, safely and comfortably the employee perceives and performs a visual work. The higher the lighting intensity, the easier it is to notice the fine details of the work done. Studies on this subject show that high lighting intensity leads to an increase in concentration and motivation, and this increases the performance of the employee by 50%. As the error rate of the employee decreases, occupational accidents are also reduced in workplaces with high lighting intensity. A large proportion of work accidents occur in workplaces where the lighting intensity is less than 200 lux [5-8].



Figure 1. Weaving machine

According to the report of the American National Safety Council, bad lighting is the cause of 5% of all occupational accidents, and this rate reaches 20% of occupational accidents when evaluated together with eyestrain caused by poor lighting. Improvement studies in the field of lighting in a factory in the heavy industry industry in the USA in the 1950s show the relationship between work accidents and lighting. In this study, after increasing the lighting intensity to 200 lux in the assembly line in the factory, a 32% decrease in the accident rate was achieved. As a next step, the walls and ceiling were painted light colors to reduce the contrast and provide more balanced lighting. As a result, an additional 16.5% decrease was observed in the accident rate. Similar studies were carried out in England and France, and a great decrease in occupational accidents was observed especially in shipyards, foundry industry, large assembly lines and workshops [9-11].

2.2. Lighting and Efficiency

There are many studies showing that productivity increases after improvements in lighting in workplaces. This increase is due to the direct effect of doing the work visually faster and the indirect effect of reducing eye strain. In a study, an increase in efficiency of 4% to 35% was

observed as a result of the increase in lighting intensity in 15 workplaces with a lighting intensity of less than 100 lux at the beginning. In another study conducted in a cotton spinning factory in the USA, when the lighting intensity was increased from 170 lux to 340 lux, the production increased by 5% and at the same time, faulty production was greatly reduced. As a result, the total cost was reduced by 27.5%. These results prompted the management to make further improvements in the field of lighting and it was decided to increase the lighting intensity to 750 lux. As a result, production increased by 10.5% compared to the initial value and the cost due to faulty products decreased by 40%. Although the illumination intensity and efficiency are directly proportional to a point, it is known that the illumination intensity above this value causes negative effects due to reflections, dark shadows, excessive contrast and glare in illuminations above 1,000 lux. The most preferred lighting intensity value of the employees is between 400-850 lux. Similar studies have been done in England, France, Germany and other countries. As a result of the increase in lighting intensity, an increase in efficiency, a decrease in faulty products and work accidents were observed [12-13].



Figure 2. Lighting for weaving machine

3. GENERAL PRINCIPLES OF MEASUREMENT

- During the lighting measurements, care is taken not to create an angle that will affect the measurements of the device in a different direction.
- Measuring personnel taking measurements by paying attention to shadow formation in the measurement area required.
- If daylight is used in the facility, the period of the measurements according to the number of shifts is day and night should be arranged in the evening.
- The location of the measurements must be in the same area and height as the working personnel's place of work [14-15].

3.1. Method and Devices Used in Measurement

The illumination measurements were made with the Lighting Measurement Device in accordance with the Measurement Of Lighting Levels In The Workplace - Canada Occupational Safety And Health Regulations, Part IV COHSR-928-1-IPG-039 standard. Below are the technical specifications of the device.

Testo 540 Model Lighting Meter:

- The device can be used to determine the lighting level in indoor and outdoor environments.
- Measurement Range: 0-99.999 Lux,
- Resolution; 1 Lux between 0-19.999, 10 Lux between 20.000-99.999.

4.LIGHTING MEASUREMENT

In the facility, the lighting level was measured in 18 different sections. Measured and calculated values are given in the table below. The unit of intensity of illumination measurements is called lux. Its symbol in physics is "lx". The illumination of a light source of the intensity of one candle at a point at a distance of one meter is equal to one lux. Luxury; It can also be defined as the amount of luminous flux falling on a unit surface.

Table 1. Lighting Values Detected in the Workplace.

	Measurement Section	Illumination Level (lux)	*Reference Value
1	Weaving Machine A1	413	300
2	Weaving Machine A2	529	
3	Weaving Machine A3	480	
4	Weaving Machine A4	488	
5	Weaving Machine A5	418	
6	Weaving Machine A6	489	
7	Weaving Machine A7	302	
8	Weaving Machine A8	362	
9	Weaving Machine A9	467	
10	Weaving Machine A10	465	
11	Weaving Machine A11	483	
12	Weaving Machine A12	570	
13	Weaving Machine A13	489	
14	Weaving Machine A14	533	
15	Weaving Machine A15	474	
16	Weaving Machine A16	495	
17	Weaving Machine A17	483	
18	Weaving Machine A18	651	

When Table 1 is examined, all lighting measurements in the lighting measurements made in the factory resulted in above the minimum value that should be in the standard. It is seen that the working environment in the weaving enterprise is in compliance with the regulations and standards.

5. CONCLUSIONS

Illumination of the areas in the working environment is an important element in the physical factors. If good lighting is desired, it cannot be said that sufficient lighting intensity is the only condition. In addition to the lighting intensity, the lighting system of the enterprise should also include different conditions. Some of these conditions are as follows;

- Lamps should be cleaned and non-working lamps should be replaced. The continuity of this process must be ensured.
- In the current risk assessments made in enterprises, it should be stated that insufficient lighting levels can cause occupational accidents.

- Local illuminators can be placed in the sections where the lighting is insufficient and more benefit from sunlight can be provided during daylight hours if possible.
- Incandescent lamps should be used instead of fluorescent lamps. Because the rays of this lamp type do not cause vibration. The eye gets tired more in order to perceive the rapid changes caused by the vibration. Therefore, an incandescent lamp does not tire the eyes compared to a fluorescent lamp.
- To be protected from the negative effects of sunlight and according to the nature of the work to be done, windows and roof lighting should be adjusted properly. The working surface should not be shaded.
- Care should be taken not to reflect the light coming from the light source.
- Care should be taken to ensure that the lighting is uniform in the working environment where the same work is done.

This study has shown that the working environments in the weaving mill are in compliance with the regulations and standards. However, some values were very close to the desired values in the standards. Therefore, recommendations regarding measures to remedy these problems should be made by the responsible parties. It is important that the thermal comfort conditions are at the desired level for the workers in the enterprises to work more efficiently.

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