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HYGIENIC ASSESSMENT OF NATURAL AND ARTIFICIAL LIGHTING IN MECHANICAL PROCESSING WORKSHOPS

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Abstract

In mechanical processing workshops, the efficiency of the labor process and the health of workers largely depend on factors of the industrial environment, including the level of lighting. Based on statistical and experimental data presented by the World Health Organization (WHO), the International Labour Organization (ILO), and leading scientific sources in industrial hygiene, it has been scientifically substantiated that insufficient lighting increases the risk of visual fatigue, occupational injuries, and production errors. Lighting is one of the oldest yet still highly relevant factors of industrial hygiene.

In mechanical processing workshops (turning, milling, grinding, and drilling operations), workers mainly deal with small parts, fast-moving mechanisms, and operations requiring high precision. Therefore, the quality of the lighting system determines not only labor productivity but also the condition of the workers' visual organs.

Work performed under insufficient lighting conditions in industrial enterprises increases visual strain by 1.5–2 times, while production errors rise by 20–30%. In particular, improper lighting in mechanical workshops poses a direct threat to the safety of technological processes.

Hygienic significance of natural lighting. Natural light is considered the most biologically optimal source of illumination for the human body. Scientific studies show that workers in naturally lit workshops experience less visual fatigue and



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have a more stable psycho-emotional state. In mechanical workshops, the placement of windows facing north or northeast ensures more uniform light distribution. However, natural lighting directly depends on seasons and weather conditions and often cannot independently provide the required standard levels.

Artificial lighting and its standards. Artificial lighting is the main source of illumination for mechanical workshops. Scientific literature recommends an illuminance level of approximately 300–500 lux for metalworking processes. The use of local lighting increases efficiency in operations requiring high precision. According to statistical data, failure to comply with hygienic requirements for artificial lighting in workshops is associated with up to a 25% increase in occupational injuries.

The hygienic assessment of lighting systems in mechanical processing workshops should not be limited solely to illuminance levels. Uniform light distribution, absence of glare effects, and color rendering indices are also of great importance. Modern studies confirm that combined lighting systems based on LED technologies are superior both in terms of energy efficiency and hygienic characteristics. However, improperly positioned luminaires can produce negative effects similar to those of classical fluorescent lamps—technology itself is not a panacea.

Lighting in mechanical processing workshops is one of the leading hygienic factors determining working conditions and directly affects the state of the workers' visual analyzer. Although natural lighting is biologically the most optimal, supplementing it with artificial lighting is a hygienic necessity. Scientific literature proves that combined lighting systems increase production efficiency and reduce occupational risks.

In conclusion, properly organized lighting in mechanical workshops is not merely a matter of comfort but the foundation of production culture and a healthy



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working environment. When the light is right, both the work and the eyes have nothing to complain about.

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