

# Influence Of Harmful And Hazardous Factors Of The Production Environment On The Health Of Workers In The Production Of Metal Structures

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Article History	Abstract
Received: 24 <sup>th</sup> April, 2026 Accepted: 20 <sup>th</sup> May, 2026	Metal fabrication is one of those industries with high levels of exposure to adverse production factors. During their work, workers are exposed to a range of harmful and hazardous factors, including industrial noise, dust, metal aerosols, welding fumes, unfavorable microclimate, significant physical exertion, and the stress of the work process. Long-term exposure to these factors can lead to the development of occupational and work-related diseases, decreased productivity, and a deterioration in the quality of life of workers.
<b>Keywords:</b> Working conditions, noise, air dustiness, microclimatic conditions, blood pressure, vital capacity of the lungs.	

## Introduction

In today's climate of intensified industrial production, the introduction of new technologies, and increased metalwork production, studying the impact of a combination of environmental factors on workers' health is particularly important. Despite ongoing occupational safety measures, many companies continue to exceed health standards for noise, dust, and chemicals in the work area, requiring further improvement of preventative measures [3, 5].

Metal fabrication is among the industries with increased exposure to adverse production factors. During their work, workers are exposed to a range of physical, chemical, biological, and psycho-emotional factors, including industrial noise, vibration, dust, metal aerosols, welding fumes, unfavorable microclimate, significant physical exertion, and the stress of the work process. Long-term exposure to these factors can lead to the development of occupational and work-

related diseases, decreased productivity, and a deterioration in the quality of life of workers [1,2,4].

**Purpose of inspection:** Based on the working conditions and health status of workers exposed to unfavorable factors in the production of metal structures, develop measures to improve working conditions and reduce morbidity.

**Inspection methods:** The scope of the inspection included the determination of meteorological conditions during the working day, including temperature and relative humidity of the air in the workplace, and air velocity using a weatheroscope. The results obtained were evaluated in accordance with SanQvaM № 0324-16 “Sanitary standards for the microclimate of production premises”. Noise levels were measured in accordance with SSBT № 12.1.050-86 “Methods for measuring noise in workplaces”. The sound pressure level was measured directly at the workplace using the SVAN-943 instrument. The results obtained were evaluated in accordance with SanN and R № 0325-16 “Permissible sanitary standards for noise levels in workplaces”. The amount of dust in the air of the main workplaces of the metal structure manufacturing enterprise was studied using the weighing method in accordance with the General Sanitary and Hygienic Requirements for the Air of the Working Zone, and the obtained samples were compared with the permitted level specified in the State Sanitary and Hygienic Regulations № 0046-95 “Hygienic Standards. Quantitative Level of Harmful Substances in the Air of the Working Zone”.

**The results and their discussion.** In industrial construction, metal structures are increasingly used. Their manufacture involves cutting, assembly, and welding, performed sequentially by fitters in high-noise, dust-prone conditions. Manual arc welding produces strong radiation and dust and gases, the composition of which is determined by the chemical components of the welding wire, the electrode coating, and the composition of the weld metal. A study of working conditions in a metalworking shop revealed that a characteristic feature is the combined effects of dust and noise on the body. The main harmful occupational factor is welding fume. Background dust levels in the shop were at 20- A study of working conditions in a metalworking shop revealed that a characteristic feature is the combined effects of dust and noise on the body. The main harmful occupational factor is welding fume. Background dust levels in the shop were at 20.

Significant dust and gas emissions are generated by large-scale welding operations and the use of gas-cutting machines in both the welding and machining

areas. As a result, dust concentrations in the air of the work area reach 40-60 mg/m<sup>3</sup>, which exceeds the standards by 6,6-10 times (state standard № 12.1.005-88). The highest dust content of 60 mg/m<sup>3</sup> was recorded in the fine welding area, exceeding the standard by 50 mg/m<sup>3</sup> (MPC – 6,0 mg/m<sup>3</sup>). Moreover, dust and gas concentrations during automatic welding are significantly lower than those during manual arc welding.

Microclimate measurements during the cold season revealed that workplace temperatures ranged from +9 to +19<sup>0</sup>C, rising from +19 to +24<sup>0</sup>C during the transitional and warm periods. Relative humidity was 40-60%, and air velocity was 0,1 m/s. Based on these data, the air temperature during the cold season was 7<sup>0</sup>C below the optimal temperature, while during the transitional and warm periods it was 2<sup>0</sup>C below the optimal temperature. Relative humidity and air velocity were within normal limits (SanN and R №0324-16).

Machine-building production is saturated with a variety of equipment and mechanisms, the operation of which generates intense noise. Time-lapse observations have shown that workers in the metalworking shop are exposed to elevated noise levels for 70-80% of their working time. During certain periods, impulse noise levels of up to 91 dBA are observed at workstations, originating from pneumatic hammers located in the forging area. At the hammers themselves, noise levels reach 104-108 dBA, indicating 24-28 dBA above the standard. Background noise levels of 75-86 dBA were recorded in the assembly and machining area. Most of the technological operations are performed by welders and fitters, either standing or squatting, and are associated with physical exertion. To assess the extent of functional changes developing in the body under the influence of hygienic working conditions, physiological studies were conducted on workers in primary occupations over the course of a shift.

A total of 110 individuals were examined, divided into three main groups based on working conditions and the work performed: 1) electric welders, 2) fitters, and 3) blacksmiths.

Blood pressure, heart rate, and electrogram were measured as cardiovascular indicators.

The cardiovascular study revealed several features of its functioning. For example, 57% of workers in Group I showed a decrease in systolic pressure. Among workers in Group II, blood pressure changes were mixed: 50% of workers showed an increase, while 37% showed a decrease. Furthermore, an increase in workers with elevated blood pressure was recorded, with the average value by the

end of the shift not exceeding  $103,0 \pm 3,2$  mm. of mercury. In workers in Group III, changes in this indicator were less pronounced. However, in the subgroup of blacksmiths over 40 years of age, a decrease in systolic blood pressure was observed. Thus, these data indicate a more intense cardiovascular system function in workers in Group I compared to Group III, which is clearly related to the nature of their work.

When analyzing cardiovascular health indicators such as diastolic blood pressure, it is important to note an increase in diastolic blood pressure by the end of the shift in 42% of workers in Groups I and III and a decrease in 50% of workers in Group II. When assessing blood pressure changes individually, we note an increase in the proportion of individuals with elevated diastolic blood pressure from 15,0% to 46,1% by the end of the shift among Group I workers over 40 years of age, and a decrease from 38,4 % to 18,2 % among workers under 30. Similar changes were also noted in Group II.

Thus, the obtained data characterizing the functional state of the cardiovascular system indicate the development of stress, which is more pronounced in workers with 30 years of experience in groups I and II.

One of the factors affecting the functional state of the respiratory system in a metal fabrication shop is the significant level of dust and gas contamination in the air. When assessing the respiratory activity of the workers being examined, taking into account their age and length of service, the following differences can be noted. While workers with up to 5 years of service in Groups I and II showed a persistent decrease in vital capacity (VC), workers in Group III showed an increase in VC.

An analysis of age group data revealed a decrease in vital capacity toward the end of a shift among workers aged 30-40. In Group III, workers aged 30-40 exhibited a more persistent decrease in vital capacity. Clearly, for workers in Group III, aged over 30-40, production loads cause a higher degree of stress, especially when combined with fatigue.

**Conclusion.** The most stressful workload for workers in metal fabrication is the combination of adverse production factors, including physical strain, noise, dust, and air pollution. The strain on the musculoskeletal system leads to fatigue, which slows down recovery processes. Long-term exposure to harmful and hazardous factors can lead to pathological processes in the body.

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