

ENSURING SAFETY DURING WELDING: RISKS AND PROTECTIVE MEASURES

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Abstract. Welding work performed in the industrial and construction industries is an important part of many production processes. However, they pose significant risks to the health and safety of welders and other personnel due to a number of factors that accompany welding processes. This article analyzes the most widespread harmful and dangerous factors, using the example of arc welding in protective gases and welding with the help of a tungsten electrode in a protective inert gas environment (TIG welding), which is widely used, in particular, in the metalworking industry.

Keywords: welding, welding works, arc welding in protective gases, TIG welding, occupational safety, risks.

Анотація. Зварювальні роботи, які виконуються у промислових та будівельних галузях, становлять важливу частину багатьох виробничих процесів. Проте, вони зумовлюють значні ризики для здоров'я та безпеки зварників та іншого персоналу через низку факторів, які супроводжують зварювальні процеси. У даній статті проведено аналіз найбільш розповсюджених шкідливих і небезпечних факторів, на прикладі дугового зварювання в захисних газах та зварювання за допомогою вольфрамового електрода в захисному середовищі інертного газу (TIG зварювання), яке знаходить широке застосування, зокрема, в металообробній промисловості.

Ключові слова: зварювання, зварювальні роботи, дугове зварювання в захисних газах, TIG зварювання, безпека праці, ризики.

Introduction. Welding is considered one of the most important processes in the industrial and construction sectors, where it ensures the connection of metal parts and structures. This process is key to manufacturing, repair and assembly, but with its benefits come risks to worker health and safety. Welding involves a number of potential hazards, from electrical shock to arcing and toxic gases [1, 2]. This article deals with various aspects of welding, in particular gas metal arc welding and TIG (tungsten inert gas) welding. We will analyze the processes of these methods in detail, as well as identify the most significant risks and ways to minimize them. Understanding these aspects is important to ensure worker safety and improve welding processes in all areas of their application.

Analysis of the state of the issue. Welding works in the modern production environment play a critical role in ensuring the connection of metal structures and parts. However, this process is accompanied by a number of potential hazards that may endanger the health and safety of workers. Gas metal arc welding is one of the most common welding methods. During this process, the wire electrode melts under a

protective gas coating, which allows for a strong weld. However, such a process involves certain risks, in particular, electrical hazards due to the use of high voltage, as well as arc radiation, which can be harmful to the eyes and skin of workers. TIG welding is another common method that uses an electric arc between a tungsten electrode and a work material protected by an inert gas. Although this method is less explosive than gas arc welding, it also introduces its own risks, including the release of toxic gases and the possibility of radiation exposure due to the use of thorium oxide tungsten electrodes. A careful analysis of the state of the issue shows that the safety of welding works is an actual topic that requires constant improvement of technologies and the implementation of safety measures. Only through a thorough understanding of the risks and the application of appropriate safety measures can safe conditions be ensured for welding operations in all branches of production.

The purpose of the work: to conduct a thorough analysis of various aspects of welding work in order to raise awareness of the potential hazards associated with this process.

Methods, materials and research results. Analysis of statistical data on workplace accidents and occupational diseases among welders allowed us to identify typical risks and trends in the occurrence of traumatic events. The article will take a detailed look at gas arc welding and TIG welding to reveal key aspects of these processes and to identify and analyze risks to worker health and safety. The main objective is to provide workers in the industrial and construction sectors with the necessary information about the risks associated with welding work and to provide recommendations for the use of appropriate safety measures. Which will promote awareness and safety among welders and other welding workers, and help reduce injuries and occupational diseases in this industry. In addition, it will help to realize the need to implement effective safety measures in the workplace to ensure the safety and health of workers engaged in welding work.

Welding work, which is commonly performed in the industrial and construction sectors, can endanger the health and safety of workers due to various sources of danger. The main aspects of the risk include both the materials and the welding process itself.

Gas arc welding is one of the most common arc welding methods, where a wire electrode is melted under a shielding gas. This gas provides protection of the arc and the welding seam from the influence of the surrounding air. Depending on the type of gas, it is possible to perform welding with an active gas (MAG) if, for example, carbon dioxide is used, or in an inert gas (MIG) if, for example, argon is used [3]. This method allows you to connect almost all types of welding materials. However, with gas arc welding, there is a high risk of electrical damage due to the lack of full protection of the welding electrodes. Arc radiation also poses a potential threat, especially intense UV radiation that can cause skin burns and inflammation of the outer eye. Workers performing welding work must use appropriate protective equipment, including helmets and protective suits, to prevent possible injuries. It is also important to watch for reflections on metal surfaces, especially on materials that can impress with their brightness and intensity of radiation [4].

During the TIG welding process, an electric arc forms between the tungsten electrode and the work material, but the electrode itself does not melt. If material needs to be added, it can be done manually with welding rods or mechanically with a wire feeder. A nozzle is installed around the arc, through which an inert gas (usually argon) is supplied to protect against the influence of the atmosphere.

TIG welding, at first glance, may seem to be the most low-emission, as there is practically no visible welding fume. However, this process can also be dangerous for health. High temperatures occur during welding, which lead to the formation of ozone and nitrogen gas (nitrogen oxide). These gases can cause nausea, headaches and lung damage. The formation of cancer when welding chrome-nickel steel is especially dangerous due to the radiation of radioactive thorium oxide contained in tungsten electrodes. The use of alternating current TIG welding, especially with aluminum materials, is also risky due to possible exposure. To ensure worker safety, it is recommended to use powerful particle extraction and filtration systems during TIG welding. It is also important to follow all safety rules and use appropriate protective equipment to prevent potential injury and illness.

Understanding these risks is essential to ensuring welding safety and applying appropriate safety measures to protect the health and safety of workers, namely [5]:

- ensure proper welding safety education and training, including the use of certified equipment and protective equipment such as safety helmets, goggles, gloves and appropriate clothing;
- create proper ventilation of the workplace, especially during welding using inert gases, to avoid poisoning from the release of toxic gases;
- regularly and thoroughly inspect and maintain welding equipment to avoid unforeseen accidents and ensure safety during work;
- minimize exposure time to arc radiation, using automated equipment that will allow welders to work at a safe distance from the arc;
- use only appropriate materials and equipment for welding work, including electrodes, gases and other auxiliary materials;
- regularly check health in order to detect any signs of injury or illness related to welding work in time.

Conclusions. Welding, despite its importance in industrial production, poses certain risks to the health of welders. These risks include arcing, release of toxic gases, and possible exposure to radioactive materials with subsequent risk of cancer. Therefore, in order to minimize the manifestation of these risks, it is necessary to take appropriate protective measures, such as the use of protective equipment and effective particle extraction and filtration systems. In addition, professional training of welders in safety matters is key to preventing injuries and occupational diseases. Knowledge and ability to identify potential hazards allows welders to work in safe conditions. Modern safety technologies and practices must be continuously monitored and implemented to ensure a safe working environment for all employees. This will contribute to the reduction of health risks and increase the overall level of safety in the

working environment, which is an important task that requires systematic measures to eliminate possible hazards.

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