
Review of Intricacies of Underwater Welding

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Abstract

One of the main challenges of underwater welding is the presence of water currents, which can make it difficult for the welder to maintain a stable position and affect the quality of the weld. Writing a literature review aims to identify gaps in existing knowledge and provide a theoretical framework for research. The research writing method involves identifying research questions, searching for relevant literature, evaluating the literature, organizing the literature, analyzing the literature, and synthesizing the literature. The research writing method involves identifying research questions, searching for relevant literature, evaluating the literature, organizing the literature, analyzing the literature, and synthesizing the literature. The research results should provide a theoretical framework, identify gaps, and provide recommendations for future research.

Keywords: under welding; ocean engineering; future technology.

1. Introduction

Underwater welding is a specialized technique that involves welding in an aquatic environment. This technique is used in various industries, including oil and gas, shipbuilding, and underwater construction. Underwater welding is a challenging and complex process that requires specialized equipment, skilled personnel, and a thorough understanding of the underwater environment.

The process of underwater welding involves two main techniques: wet welding and dry welding. Wet welding is the most common technique used in underwater welding. It involves welding in the water using a particular electrode designed to work in a wet environment. The electrode is connected to a welding machine on the surface, and the welder uses a diving mask and a regulator to breathe underwater. Wet welding is challenging because the welder must work in a wet environment, which can be hazardous due to water currents, marine life, and other underwater hazards.

On the other hand, dry welding is a more complex and expensive technique that involves welding in a dry environment. This technique is used in situations where wet welding is not possible or practical, such as in deep water or areas with strong currents. Dry welding involves creating a dry chamber around the welding area using a special enclosure called a habitat. The habitat is pressurized with air, and the welder works inside the chamber using specialized equipment and tools. Dry welding is safer and more efficient than wet welding but requires more time, equipment, and personnel.

Underwater welding is a challenging and hazardous process that requires specialized training and equipment. The welder must be skilled in welding and diving and thoroughly understand the underwater environment. The welder must also be able to work in a team environment, as underwater welding often involves multiple personnel working together to complete a project.

One of the main challenges of underwater welding is the presence of water currents. Water currents can make it difficult for the welder to maintain a stable position and affect the weld's

quality. To overcome this challenge, underwater welders use specialized equipment such as underwater thrusters and positioning systems to keep a challenging situation.

Another challenge of underwater welding is the presence of marine life. Marine life can be attracted to the welding area due to the heat and light generated by the welding process. It can be hazardous to both the welder and the marine life. To prevent this, underwater welders use specialized equipment such as underwater lights and barriers to keep marine life away from the welding area.

2. Materials and Methods

This article is done by collecting and analyzing information from various sources related to the research topic. The literature review aims to identify gaps in existing knowledge and provide a theoretical framework for research. Methods of writing literature review research involve identifying research questions, searching for relevant literature, evaluating the literature, organizing the literature, analyzing the literature, and synthesizing the literature. The research writing method of the literature review provides a theoretical framework for research and identifies gaps in existing knowledge.

The first step is identifying questions about underwater welding. Research questions must be clear and specific. It must be based. Once the research question is specified, the next step is to search the relevant literature. Literature can be found in various sources such as books, journals, articles, and online databases. It should be evaluated based on its relevance, reliability, and validity. The significance of the literature should be based on its relationship to the research question and the source's credibility. The fact of the literature must be found on the accuracy of the information. Next, organizing and analyzing the literature. So, The synthesis should also identify research gaps and provide recommendations for future research.

3. Results

3.1 Underwater Welding on oil and gas industry

Underwater welding is a crucial process in the oil and gas industry. It involves joining two metal parts underwater, which is challenging due to the harsh environment and the need for specialized equipment. The process is essential in maintaining and repairing offshore structures, pipelines, and other underwater equipment. In this essay, we will discuss the importance of underwater welding in the oil and gas industry, the challenges faced during the process, and the safety measures taken to ensure the safety of the welders.

The oil and gas sector is among the most crucial industries globally, as it supplies energy to fuel households, enterprises, and factories. This industry functions in severe settings, such as offshore rigs, pipelines, and underwater machinery. These constructions are vulnerable to extreme weather, rust, and other types of damage. As a result, they require regular maintenance and repair to ensure their safety and longevity. Underwater welding is a crucial process in the maintenance and repair of these structures.

Underwater welding is a complex process that requires specialized equipment and skilled personnel. The process involves using an electric arc to melt the metal parts to be joined. The welder must be able to work in a confined space, in complete darkness, and a high-pressure environment. The water temperature, currents, and visibility also affect the process. The welder must be able to work under these conditions while maintaining the quality of the weld.

One of the challenges faced during underwater welding is the high-pressure environment. The pressure increases with depth, and the welder must be able to work under these conditions without compromising their safety. The welder must also be able to work in complete darkness, which can be disorienting and dangerous. The visibility is also affected by the water temperature and currents, which can make it difficult to see the work area. The welder must be able to work under these conditions while maintaining the quality of the weld.

Another challenge faced during underwater welding is the risk of electrocution. The electric arc

used in the welding process can create a dangerous electrical current that can harm the welder and other personnel in the area. The welder must be trained to use specialized equipment to prevent electrocution and ensure safety. The equipment includes insulated gloves, boots, and helmets, as well as specialized welding machines that are designed for underwater use.

3.2 Underwater welding management

Underwater welding is critical in various industries, such as oil and gas, shipbuilding, and marine construction. It involves welding in an aquatic environment, which poses significant risks to the welder and equipment. Therefore, implementing underwater welding management is crucial to ensure the welder's safety and the welding project's success.

One of the primary reasons why underwater welding management is essential is to prevent accidents and injuries. Welding in an aquatic environment is hazardous due to water pressure, low visibility, and the risk of electrocution. Therefore, safety measures such as using protective gear, proper training, and adherence to safety protocols are necessary to prevent accidents and injuries.

Another reason underwater welding management is crucial is to ensure the quality of the welding project. Welding in a submerged environment requires specialized equipment and techniques that are different from those used in conventional welding. Therefore, proper management is necessary to ensure that the equipment used is in good condition and that the welder is trained and experienced in underwater welding.

Moreover, implementing underwater welding management is essential to minimize the environmental impact of the welding project. Welding in an aquatic environment can cause damage to marine life and the ecosystem. Therefore, proper management is necessary to ensure that the welding project is carried out in an environmentally friendly manner.

In conclusion, implementing underwater welding management is crucial to ensure the welder's safety, the welding project's success, and the environment's protection. Therefore, it is essential for companies that engage in underwater welding to prioritize the implementation of proper management practices to ensure that the welding project is carried out safely and efficiently.

3.3 Specifications of underwater welding equipment

Underwater welding is a specialized field that requires specific equipment to ensure the welder's safety and the weld's quality. The equipment used for underwater welding must be designed to withstand the harsh underwater environment and provide the necessary protection for the welder. In this essay, we will discuss the specifications and rules of underwater welding equipment.

The first and most important specification for underwater welding equipment is that it must be waterproof. The equipment must be engineered to endure the pressure of saltwater and its corrosive properties. The welding machine must be hermetically sealed to avert water ingress and potentially harm the electrical components. The cables and connectors must also possess waterproof properties to forestall electrical shock and short circuits. Another important specification for underwater welding equipment is that it must be portable. The equipment must be easily transported and set up at the job site. The welding machine must be compact and lightweight, and the cables must be flexible and easy to maneuver in tight spaces. The equipment must also be easy to operate, with simple controls that can be adjusted quickly and easily.

The welding machine used for underwater welding must also be capable of producing high-quality welds. The device must have a stable arc penetrating the metal being welded. The appliance must also maintain a consistent welding speed and make a uniform weld bead. The welding machine must also be able to operate at high currents to ensure that the weld is solid and durable. In addition to the equipment specifications, some rules must be followed when using underwater welding equipment. The first rule is that the welder must be trained and certified to perform underwater welding. The welder must also have the proper safety gear, including a diving helmet, gloves, and a wetsuit.

Another rule for underwater welding is that the welder must have a clear view of the welding area. The welding area must be well-lit, and the welder must have a clear line of sight to the weld.

The welder must also be able to communicate with the surface crew using a two-way radio or another communication device.

Finally, there are rules regarding the safety of welding equipment. The welding machine must be properly maintained and inspected before each use. The cables and connectors must be checked for damage or wear, and the welding machine must be tested to ensure it functions properly. The welding machine must also have safety features, such as a circuit breaker and a ground fault interrupter.

3.4 Underwater welding technology

Underwater welding is a process that involves welding two pieces of metal together underwater. This process is used in various industries, including oil and gas, shipbuilding, and underwater construction. The use of technology in underwater welding has revolutionized the industry, making it safer, more efficient, and more cost-effective. One of the most significant advancements in underwater welding technology is the development of wet welding. Wet welding is a process that involves welding underwater without the need for a dry environment. This technology has made underwater welding more accessible and cost-effective. Wet welding is used in various industries, including shipbuilding, offshore oil and gas, and underwater construction.

Another significant advancement in underwater welding technology is remote-controlled welding systems. These systems allow welders to control the welding process from a safe distance, reducing the risk of injury and increasing efficiency. Remote-controlled welding systems are utilized across diverse industries, such as offshore oil and gas, shipbuilding, and underwater construction. The incorporation of robotics in the field of underwater welding constitutes a significant technological progression. Robotic welding systems demonstrate exceptional precision and accuracy in the execution of tasks, surpassing those of human welders. These systems are utilized across various industries, such as offshore oil and gas, shipbuilding, and underwater construction.

The use of technology in underwater welding has also led to the development of new welding techniques. One such technique is friction stir welding. Friction stir welding is a process that involves using a rotating tool to join two pieces of metal together. This technique is used in various industries, including shipbuilding and underwater construction. The use of technology in underwater welding has also led to the development of new welding materials. One such material is super duplex stainless steel. Super duplex stainless steel is a corrosion-resistant material used in various industries, including offshore oil and gas, shipbuilding, and underwater construction.

The use of technology in underwater welding has also led to the development of new safety measures. One such measure is the use of hyperbaric chambers. Hyperbaric chambers are used to treat divers exposed to high-pressure environments. These chambers are also used to treat divers injured during underwater welding.

4. Discussion

4.1 Safety level on underwater welding

Underwater welding is a challenging and risky task that requires a high level of expertise and safety measures. The welding process involves joining two metal pieces underwater, which can be dangerous due to the high pressure, low visibility, and the risk of electrocution. Therefore, safety is a crucial aspect of underwater welding, and it is essential to follow the necessary precautions to ensure the welder's safety and the surrounding environment. One of the critical safety measures in underwater welding is using proper equipment. The welder must use specialized equipment for underwater welding, such as a welding helmet, gloves, and boots. The equipment must be waterproof and insulated to prevent electric shock. Additionally, the welding machine must be designed for underwater use and grounded correctly to avoid electrical hazards.

Another essential safety measure is the use of a diving team. The diving team consists of a diver and a standby diver responsible for monitoring the welder's safety and assisting in an emergency. The diving team must be trained in underwater welding safety. It must have the necessary equipment, such as oxygen tanks and communication devices, to ensure their and the welder's

safety. The welding site must also be adequately prepared to ensure safety. The site must be free of any debris or obstructions that can cause accidents. Additionally, the welding area must be nicely illuminated to ensure visibility, and the water must be clear of any contaminants that can affect the welder's health.

The welder must also follow specific safety procedures during the welding process. The welder must ensure that the welding machine is properly grounded and that the welding cables are not damaged. Additionally, the welder must avoid touching metal surfaces while welding to prevent electric shock. The welder must also monitor the welding area for any signs of gas leaks or other hazards. In conclusion, safety is a critical aspect of underwater welding, and it is essential to follow the necessary precautions to ensure the welder's safety and the surrounding environment. Proper equipment, a diving team, proper site preparation, and specific safety procedures during welding are all crucial to ensure a safe and successful underwater welding operation. By following these safety measures, we can minimize the risks associated with underwater welding and ensure the safety of everyone involved.

4.2 Degree of risk in underwater welding

Underwater welding is a specialized field that involves welding in an aquatic environment. It is a challenging and risky job that requires a high level of skill and expertise. The degree of risk involved in underwater welding is significant, and it is essential to understand the potential hazards before undertaking this type of work. One of the most significant risks associated with underwater welding is the danger of electric shock. Welding equipment generates high levels of electricity, and if not handled correctly, it can cause severe injury or even death. The risk of electric shock is even higher in an aquatic environment, where water can conduct electricity and increase the risk of electrocution. To alleviate this potential hazard, underwater welders must receive comprehensive training in safely handling welding equipment and using appropriate safety attire, including insulated gloves and boots.

Another significant risk associated with underwater welding is the danger of drowning. Welders must work in an environment surrounded by water; if they are not careful, they can quickly become trapped or entangled in equipment. Additionally, underwater welders must be able to hold their breath for extended periods, which can be challenging and dangerous. To mitigate the potential hazard of drowning, it is imperative that underwater welders receive comprehensive instruction in appropriate diving methodologies and consistently collaborate with a colleague who can provide aid in the event of an unforeseen circumstance.

The risk of explosion is also a significant concern in underwater welding. Welding equipment generates heat, and if not handled correctly, it can cause an explosion. Additionally, underwater welding often involves working with flammable materials, which can increase the blast risk. To alleviate this potential hazard, it is imperative that underwater welders receive comprehensive training in appropriate welding methodologies and consistently operate within a sufficiently ventilated environment.

Finally, underwater welding can also pose a risk to the environment. Welding equipment can generate toxic fumes and chemicals, harming marine life and the ecosystem. To mitigate this potential hazard, it is imperative that underwater welders receive training in appropriate waste disposal techniques and consistently adhere to environmental regulations. The risk associated with underwater welding is substantial, and it is crucial to comprehend the potential hazards before engaging in this type of work. Underwater welders must receive instruction in proper safety protocols and always work with a partner who can assist in an emergency. Furthermore, they must remain aware of the potential environmental risks and operate following all applicable environmental regulations. With appropriate training and safety measures, underwater welding can be a fulfilling and rewarding career.

4.3. ISO standards for underwater welding

Underwater welding is a challenging and risky profession that requires a high level of skill and expertise. It involves welding underwater, which can be hazardous due to water pressure, currents,

and other environmental factors. To ensure the safety and quality of underwater welding, the International Organization for Standardization (ISO) has developed a set of standards that underwater welders must follow.

ISO is a non-governmental organization that develops and publishes international standards for various industries, including welding. The ISO standards for underwater welding cover many topics, including safety, quality, and environmental protection. These standards ensure that underwater welding is performed safely and efficiently and that the resulting welds are of high quality. One of the most critical ISO standards for underwater welding is ISO 15618-1:2016. This standard provides guidelines for the qualification testing of welders for underwater welding. It specifies the requirements for the qualification of welders, including the necessary skills, knowledge, and experience. The standard also outlines the testing procedures that must be followed to ensure that welders are qualified to perform underwater welding.

Another necessary ISO standard for underwater welding is ISO 15618-2:2016. This standard provides guidelines for the qualification testing of welding procedures for underwater welding. It specifies the requirements for qualification welding procedures, including equipment, materials, and techniques. The standard also outlines the testing procedures that must be followed to ensure that welding procedures are qualified for underwater welding.

The standard ISO 15618-3:2016 holds great importance in the field of underwater welding. It presents extensive directives for testing the eligibility of welding operators who perform underwater welding. The standard specifies the prerequisites for the qualification of welding operators, including the fundamental abilities, understanding, and expertise required for the job. The measure also outlines the testing procedures that must be followed to ensure that welding operators are qualified to perform underwater welding.

In addition to these standards, ISO has developed standards for inspecting and testing underwater welds. These standards specify the requirements for inspecting and testing welds, including the necessary equipment, techniques, and procedures. The standards also outline the criteria for evaluating the quality of underwater welds. ISO standards are essential for ensuring the safety and quality of underwater welding. By following these standards, underwater welders can ensure that they perform their work safely and efficiently and that the resulting welds are of high quality.

4.4 The Future of underwater welding

Underwater welding is a specialized field that involves welding in an aquatic environment. It is a challenging and dangerous job that requires a high level of skill and expertise. The future of underwater welding is bright, with new technologies and techniques being developed to make the job safer and more efficient. One of the most significant advancements in underwater welding is using remote-operated vehicles (ROVs). These vehicles are equipped with cameras and sensors that allow welders to work in areas that are too dangerous or inaccessible for human divers. ROVs can also be used to inspect and repair underwater structures, reducing the need for human intervention.

Another technology that is revolutionizing underwater welding is the use of laser welding. Laser welding is a precise and efficient method of welding that uses a high-powered laser beam to melt and fuse metals. This method is advantageous in underwater welding, as it can be performed without a shielding gas or flux. Laser welding is also faster and more accurate than traditional welding methods, making it ideal for large-scale underwater projects. In addition to new technologies, new techniques are being developed to improve the safety and efficiency of underwater welding. One such technique is dry welding, which involves creating a dry environment around the welding area using a specially designed enclosure. This method eliminates the need for divers to work in wet conditions, reducing the risk of accidents and injuries.

Another technique that is gaining popularity is friction stir welding. This method uses a rotating tool to create friction between two metal surfaces, which generates heat and causes the metals to fuse. Friction stir welding is beneficial in underwater welding, as it can be performed without a shielding gas or flux and produces a high-quality weld with minimal distortion. Despite these advancements, underwater welding remains a dangerous and challenging job. Welders must

contend with various hazards, including underwater currents, low visibility, and the risk of electrocution. New safety protocols and training programs are being developed for underwater welders. Advancements in technology, such as remote-operated vehicles, laser welding, dry welding, and friction stir welding, are making the job safer and more efficient. Underwater welding will become more important as these technologies evolve.

5. Conclusions

Underwater welding is a specialized technique used in various industries, such as oil and gas, shipbuilding, and underwater construction. It involves two main methods: wet welding and dry welding. Wet welding involves welding in the water using a particular electrode connected to a welding machine on the surface. Dry welding involves creating a dry chamber around the welding area using a special enclosure called a habitat. Underwater welding is a challenging and hazardous process that requires specialized equipment, skilled personnel, and a thorough understanding of the underwater environment.

The oil and gas industry is one of the most critical industries in the world, operating in harsh environments. Underwater welding is a complex process that requires specialized equipment and skilled personnel. It involves using an electric arc to melt metal parts to be joined, and the welder must be able to work in a confined space, in complete darkness, and a high-pressure environment. The welder must be trained to use specialized equipment to prevent electrocution and ensure their safety. Underwater welding management is essential to ensure the safety of the welders.

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