

## Some arc welding methods using in shipbuilding

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**Abstract:** After a long period of crisis, Vietnam's shipbuilding industry is recovering. However, there are still many difficulties and challenges as the world's shipbuilding market has not really escaped. Welding is a metal working process that connects the parts together into a non-disassembled piece by firing a metal to a welding state (liquid - solder melting, plastic - welding), crystalline metal or diffusers to form a welded joint. The characteristics of welding are metal saving, high strength, good tightness, simple welding equipment, lightweight, easy to manufacture, easy to apply automation, multi product can be welded to a variety of metals, welds can be machined with many complex parts that other machining methods cannot do, welds that produce excess stresses including thermal stresses and stresses. The metal-clad welded edge is always well-organized overheat, not high mechanical properties.

**Keywords:** overhead crane, welding, mechanical properties

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### 1. Introduction

A long coastline with a more than one million square kilometers, Vietnam is one of the 10 countries with the highest coastline in the east, south and southwest. , Vietnam has always been identified as a country with a favorable position to develop the shipbuilding industry. In addition, the Marine Strategy of Vietnam until 2020 has identified the marine economy as the driving force to attract and promote other areas to develop, creating a fundamental and comprehensive transformation of the marine economic structure towards the public. modernization and an important solution for the implementation of the Marine Strategy until 2020 is to develop the shipbuilding and repair industry. Together with the increasing demand for transportation in the course of Vietnam's integration into the international economy, these are opportunities and potential for the shipbuilding industry to recover and develop sustainably. By the end of 2014, the Government issued the Shipbuilding Industry Development Action Plan on the basis of strategic cooperation with Japan. With this plan, the Government is determined to make the shipbuilding industry a key player in the implementation of the Marine Economics Strategy. This will focus on the production of a number of products suitable for the development of Vietnam and establish confidence in the world market about Vietnam is a country with a high quality shipbuilding industry. The increase in output value of the whole industry reached 5-10% per year. It is no coincidence that Vietnam's shipbuilding market has been receiving the attention of many countries, shipping companies, including major powers and shipbuilding corporations. Damen, a major Dutch shipbuilder, has invested \$ 60 million to build Damen - Cam River shipbuilding joint venture. Since 2003, Damen has completed more than 100 shipbuilding products at the Cam River Shipbuilding Factory, in close cooperation with the two companies, according to JF Van Drenth, Director of Technical Cooperation of Damen Group. side. With good skill and good management, Cam River Shipyard has fulfilled its commitment to quality standards by Damen, ensuring the progress and delivery time of the ship. According to Damen, the company is in the process of discussing the investment at Ben Kien (Hai Phong) of Song Cam Shipyard. Specific information has not been revealed by Damen, but the level of investment may be similar to the previous period.

Vietnam's shipbuilding industry has been heavily invested since 2002 and is in the process of taking over from major shipping hubs in Asia. Currently, in addition to Vinashin, which was established in 2006 (now the Shipbuilding Industry Corporation - SBIC), as the core, Vietnam's shipbuilding industry has shipyards owned by the Corporation. Vietnam Maritime (Vinaline), Vietnam National Oil and Gas Group and other state corporations and corporations, shipyards under management of Ministry of Defense, local enterprises and FDI enterprises. In line with the global shipbuilding crisis, Vietnam's shipbuilding industry has experienced ups and downs. The breakdown of Vinashin has caused the shipbuilding industry, together with tens of thousands of workers, to fall into disrepair as a series of small and large shipyards in Vietnam have been canceled. Given the importance of this industry, the Government has determined to direct the restructuring of the shipbuilding industry vigorously. As for Vinashin (now SBIC), from 2010 to 2015, the corporation has to focus on restructuring and processing bad debts. This is also the period when the company encountered many difficulties due to the cancellation of the contract by foreign partners, the traditional customers are Vietnam National Shipping Lines (Vinalines) also halted the project to ship dozens of ships. So far, with great support from the State, SBIC has been restructured and has gone out of bankruptcy. According to the SBIC leaders, in 2015, the whole company has deployed 254 products, including 15 fishing vessels, 20 fishing vessels, 143 other products

and inland waterway vehicles ..., handed over 178/254 products The total profit of the corporation reached more than 1,000 billion VND. The Nam Trieu Shipbuilding (Hai Phong) Shipyard has also restored 56,000 tonnes of shipbuilding and continues to make some large vessel shipments and search for new shipowners. Mr. Dang Van Canh, General Director of Ben Thuy Shipbuilding Co., Ltd. said that his company specialized in building ships such as cargo ships, passenger ships, and towing ships and has built up to 7,000 tons of ships. However, during the difficult period, the project was stagnant, the operation of enterprises almost stopped, so far the company has been expanding the product category, going into other areas such as yachts, ships fish shell steel, new material shell. The company is also preparing to sign two contracts to build 3,000 tons of cargo.



Figure 1. Vietnamese shipbuilding in Vietnam

Vietnam's shipbuilding industry is facing with many difficulties and limitations. A specialist in the international shipping brokerage Maersk Broker, the shipbuilding market worldwide is fierce as demand for shipbuilding is decreasing. Prices in all segments of the ship are relatively low and shipbuilders in general are competing aggressively in all areas such as ship type, price, financial and service strategy. In terms of internal limitations, the construction capacity of Vietnam's shipbuilding industry is currently only 30-40% of designed capacity. Supporting industries are very important for shipbuilding industry, but the pace of development of supporting industries is slow, the investment is scattered and the target of localization is not achieved. In terms of human resources, shipbuilders with international certificates are far less than required. Designers, according to experts, technical design stages are now only meet the requirements for small and popular ships. Vietnam does not have a model tank of international standard to develop new designs, the entire technical design of the ship is still imported from foreign countries. This is the weakest point of Vietnam shipbuilding industry today and will remain weak in the future if no priority investment policy, training engineers design.

## 2. Arc welding methods

### 2.1. Arc welding under drug support - Submerged arc welding (SAW)

Arc welding under the auxiliary layer is the method by which the ends of the welded or arc welded in the dispersant cover the entire weld, so that the welding arc is not visible. Welding wire is continuously fed into the arc and melted. The arc passes through the arc and heat of the arc to heat the welded wire, propellant and part of the base metal to form the weld pool. The appropriate thickness of the protective layer protects the arc and welding puddle against the effects of the air environment. The difference in the arc welding method under the SAW is a fine particle filler that covers the entire welding area to prevent arc emission, metal splashing, and smoke. Adjuvants are an important factor in achieving the fast and high quality of this method. In addition to this, in addition to arc protection, the weld also produces slag to protect the weld metal during the cooling process, oxidation, and insulation of the weld to reduce the cold velocity of the weld and help the weld into the profile of the welding line.

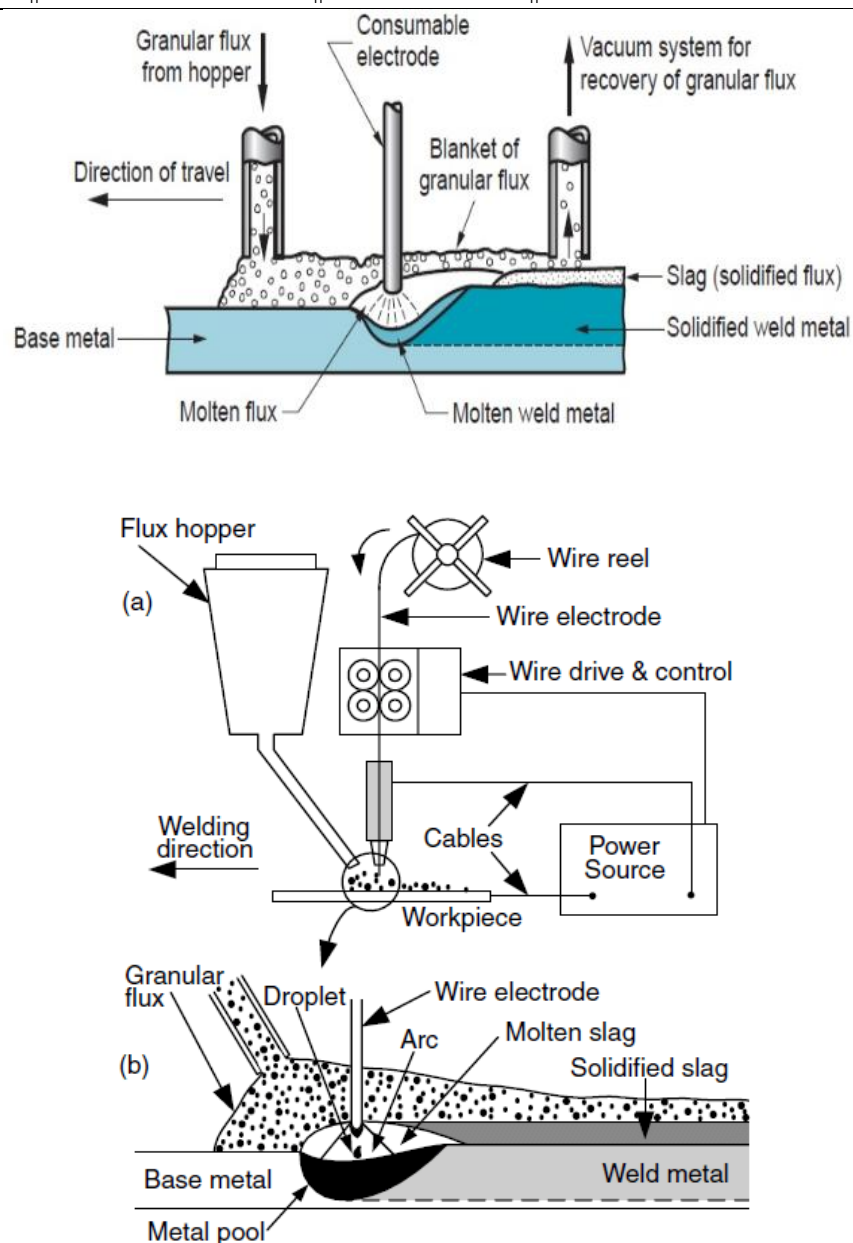


Figure 2. SAW welding method

**Characteristics:** High labor productivity, Good solder joints with good impact strength, good toughness and uniform appearance, The amount of heat concentrated in the large weld due to the drug coating around the arc should reduce the heat loss. High welding speed reduces weld distortion, High equipment costs, Applicable only to long, straight welds and high accuracy.

**Application:** SAW methods are widely used such as steel girder, pressure equipment and especially in shipbuilding industry. This welding method can be used to weld carbon steel, low alloy steel, and can even be used to weld high alloy steels, tempered steels, and stainless steels and is a very useful welding process in the welding surface hardening.

**Equipment for welding SAW:** Welding equipment includes: welding head, welding source, feeder and recovery kit. Soldering heads include: wiring harnesses, wiring systems, propellants, trolleys and welding heads. Wiring systems can be of two types: voltage-sensing systems and constant speed systems. Sub-arc welding can use both DC and AC. Therefore, rectifier transformers or transformers can be used. The main requirement of submerged arc welding is to provide high currents at high cycles.

### 2.1. Arc welding by tungsten electrodes in inert gas - (TIG)

Tungsten inert gas (TIG) is also called non-melting electrode welding in a gaseous environment. The tungsten diffuser between the tungsten electrode is not melted and the welded part is protected by the airflow through the nozzle, which will provide a detailed melting point for the melting of the edge, and then with or without the wax applied to the weld. Metallic fillers (0.8 - 4 mm diameter) are added to the hand-washing pail by hand, or by automated equipment using wire rolls. Automatic welding can use argon and hydrogen.

**Characteristics:** Non-melting electrode, no slag due to no solder, Arc, easily observable and easy to control, heat source is concentrated and high temperature. High quality welds, good welds, no slag, and can be welded in all positions. This method can be welded to most metals and alloys, or soldered to different metals. TIG welding is suitable for welding thin sheets and welded lining for all materials. Work efficiency is low. Welder requirements are high. The cost of this method of welding is high due to its low productivity, expensive equipment and materials.

**Application:** An effective method for welding aluminum, stainless steel and nickel alloys. In addition, it is possible to weld hard-metal alloys such as titanium, copper.

#### Materials in TIG welding:

**Gas Protection:** Any inert gas can be used for TIG welding, but argon and helium are preferred over both because of the relatively low cost and availability.

Argon is colorless, odorless, tasteless and non-toxic. It does not form chemical compounds with any other material at any temperature or pressure. Argon gas is extracted from the atmosphere by air purification and purified to a purity of 99.9%, with a density of 1.33. Argon is supplied in high pressure tanks or liquefied petroleum gas at -1840C in tanks.

Helium is a colorless, odorless gas. The density of air is 0.13 extracted from natural gas, with a very low liquid temperature of -2720C, usually contained in high pressure vessels.

**Electrode:** Tungsten electrode is used for electrodes due to high heat resistance, high melting temperature (34100C), relatively good electromagnetic emission, ionizing arc and maintaining arc stability. Very high oxidation.

**Solder:** TIG welding method can be welded without welding rod, depending on the type of joints and welding metals. At the same time, welding on thin material can be used to seal and weld without welding. Selecting electrodes should best suit the composition of the weld metal to ensure uniform welds, without any metallurgical disadvantage. The welding solder used for TIG welding must be coated with a sufficiently thick layer of antioxidant material to protect the solder without causing any metallic adverse effects such as gas, oxide/silicon.

**Equipment:** The equipment includes the following components: DC (DC) or AC (alternating current). Water cooled heatsink is applied when welding with large current. Bottle with protective gas pressure reducing valve and flowmeters and air ducts. Welded torches (with or without water-cooling system) with pre-welded cables. Mass clamp and wire. There are also protective equipment: masks, hand castors, windshields.

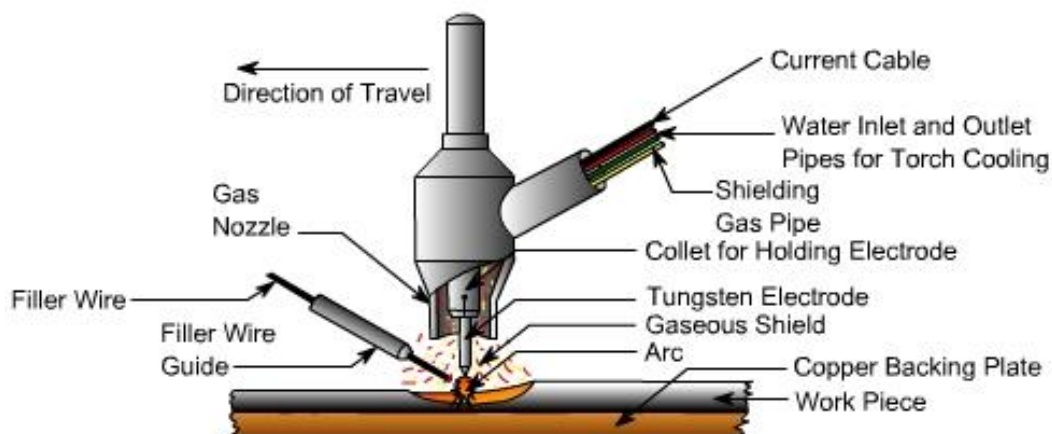


Figure 3. TIG welding method

### 3. Conclusion

Although the current shipbuilding industry has not completely overcome the difficult but hidden challenges, it is also the opportunities. This is the time for enterprises operating in the shipbuilding industry to evaluate and perfect the organizational structure, strengthen the brand name, continue to maintain and aim for long-term and sustainable development. The paper presented two of the many welding methods that can be applied in the shipbuilding industry in Vietnam

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