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A Review of Study And Analysis of Electric Arc Welding In Air And Underwater

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Abstract
Underwater welding has made amazing progress in the several years. Any repair method underwater will require the use of underwater welding. The problems in underwater welding have also been discussed in context to the existing welding techniques.The welding machine frame must be grounded to the ship. The welding circuit must include a positive type of switch, usually a knife switch operated on the surface and commanded by the welder-diver. This paper shows the electric underwater welding to assist the maintain of higher range of ultimate tensile strength.

Keywords: *Electric arc welding, Underwater welding, Electric arc welding in air, Electric arc welding in underwater.*

INTRODUCTION

The technique was usually limited to the shielded metal arc process (commonly known as stick welding). Wet welding is a situation where both work and welder are in contact with the water. This welding first ever used by Van Der Willingen in 1946. This type of weld quality has been especially limiting to pipeline welding. In addition to the metal arc process, various approaches to underwater welding have been investigated including this welding process.

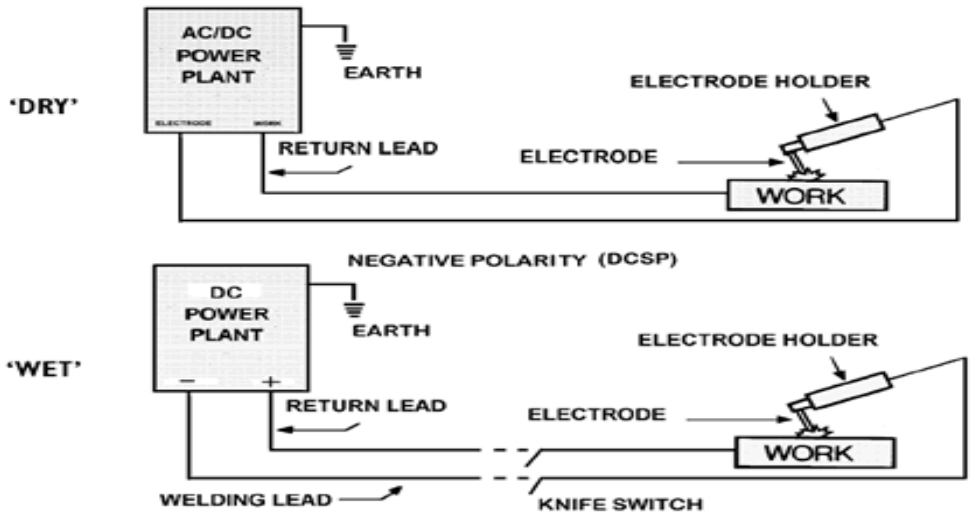

Figure 1 A typical welding circuit diagram, for surface welding (top) and wet welding (bottom).

CLASSIFICATION OFUNDERWATER WELDING

Underwater welding can be divided mainly in two types;

1) WET UNDERWATER WELDING

Wet welding is performed directly in the water, i.e; without any isolation of electrode, the arc or a work piece from the

environment.Divers usually use around 300–400 amps of direct current to power their electrode, and they weld using varied forms of arc welding.The process is generally limited to low carbon equivalent steels, especially at greater depths, because of hydrogen-caused cracking.

DRY UNDERWATER WELDING

In this technique, specially designed enclosures are being used to keep the welding equipment and components to be welded, in dry condition. Dry underwater welding involves the weld being performed at raised pressure in a chamber filled with a gas mixture sealed around the structure being welded. Overall a degradation in capability and efficiency results as the pressure increases[1-12].

ARC CHARACTERSTICS

A thermal plasma is in thermal equilibrium; the temperature is relatively homogeneous throughout the atoms, molecules, ions and electrons. A welding arc is sustained electrical discharge through a high temperature conducting plasma, producing sufficient thermal energy so as to be useful for joining of metal by fusion. The current may be concentrated in a very small hot spot on the cathode; current densities on the order of one million amperes per square centimeter can be found. Unlike a glow discharge, an arc has little discernible structure, since the positive column is quite bright and extends nearly to the electrodes on both ends.The arc occurs in the gas-filled space between two conductive electrodes (often made of tungsten or carbon) and it results in a very high temperature, capable of melting or vaporizing most materials. Electric arc furnaces are used to produce steel and other substances. Today, low-pressure electric arcs are used in many applications. For example, fluorescent tubes, mercury, sodium, and metal halide lamps are used for lighting.

ARC STABILITY

Arc stability is determined in high current welding tests in two ways: by measuring the vibration, welding current and voltage; and by recording the brightness variations of the arc. The vibration, measured in m/s^2, is substantially higher for the copper coated wire, while voltage and welding current vary within a larger scatter band. This is usually associated with emissivity variation on different spots of the electrode because an arc seeks a point of highest emissivity. Arc stability is also affected by the non-symmetrical flow of plasma et. This can be checked from the volt-ampere transient traces of the welding arc. The stability of the welding process can be determined also on the basis of an analysis of noise emittedor arc light, acoustic emission from a material or by means of a high-speed camera recording occurrences in the arc[13-18].

ARC BEHAVIOUR

Hibsman and Jensen, found welds stronger in tension than base plate when they used cellulosic electrodes. Thus rutile electrodes are preferred over cellulosic electrodes. Iron oxide coated electrodes provides better strength and ductility than plain rutile electrodes in flat and horizontal positions, whereas, for multi pass, all position welding, these rods fails because the molten pool is difficult to manage in other positions and the heavy slag is difficult to remove.Soft arc provided by rutile and iron powder electrodes.

LITERATURE SURVEY

When the welding speed was taken as a variable parameter, the deepest penetration was obtained in At Max Heat Input Rate. Maximum depth of penetration was obtained when heat input rate was maximum. Hence it can be concluded that increasing the speed of travel and

maintaining constant arc voltage and current will increase penetration until an optimum speed is reached at which penetration will be maximum. Increasing the speed beyond this optimum value will result in decreasing penetration. **TEWARI (2010).**

Hardness testing and toughness for real welded joints of mild steel were foreseen by the experiment plan. During real cycle welding tests, welding for the cooling Time was set up as indicated in Welding in room temperature[19-23]. Hardness was measured on every specimen from every single welded butt welded joint plate. In addition, welding parameters were also recorded for both recording methods, received data was found to match fully (with no discrepancy). Welding parameters (voltage, welding current, welding speed, and heat input rate are given). **M. DUNER (2008).**

The input welding parameters such as welding current and voltage data are collected dynamically during arc welding processes and the same is analyzed for its quality of input. With a data acquisition speed up to 2000 samples per second, the collected data is being analyzed using WRI developed software. The software enables to evaluate the power source characteristics like arc stability, arc ignition, and spatter level in a graded index. The system can also be employed to compare and rank a best power source among the lot. In addition, an accepted power source can be used as a bench mark for evaluation of further power sources.

R&D BHEL (2009).
To consistently produce high quality of welds, arc welding requires experienced welding personnel. One reason for this is the need to properly select welding parameters for a given task to provide a good weld quality which identified by its micro-structure and the amount of spatter, and relied on the correct bead geometry size. Therefore, the use of the control system in arc welding can eliminate much of the "guess work" often employed by welders to specify welding parameters for a given task.**KIM (2005).**

McGlone and Chadwick have reported a mathematical analysis correlating process variables and bead geometry for the submerged arc welding of square edge close butts. Similar mathematical relationship between welding variables and fillet weld geometry for gas metal arc (GMA) welding using flux cored wires have also been reported. **CHANDEL** first applied this technique to the GMA welding process and investigated relationship between process variables and bead geometry. These results showed that arc current has the greatest influence on bead geometry, and that mathematical models derived from experimental results can be used to predict bead geometry accurately..Nearly 90% of welding in world is carried out by one or the other arc welding process; therefore it is imperative to discuss the effects of welding parameters on the weld ability of the materials during the arc welding. Mild steel is the most common form of steel because its price is relatively low while it provides material properties that are acceptable for many applications. **Doherty (1978).**

The effect of welding parameters (power input, weld geometry, welding speed, and post-weld heat treatment) on the corrosion behavior of austenitic stainless steel in chloride medium was investigated in this work. Electrode potential measurement coupled with zinc rod reference electrode was used to evaluate the corrosion behavior of the samples. It was found that the 3.6kW power input produces the highest resistance weld corrosion while chamfered face edge preparation is the

best corrosion resistant sample in the chloride medium. The post-weld heat Treatment proved that the best heat treatment temperature occurred at a range between 700^{o} and 800^{o}C while the medium-speed welded ASS sample proved to be best compared with the fast-speed and the low-speed weld. The results also show that the best electrode for welding stainless steel is a stainless steel-core electrode.**AFOLABI (2008).**

Generally the quality of welded joint is strongly influenced by process parameter during the welding process. In order to achieve high quality welds, the bead geometry and mechanical properties of the weldments should be provided accuracy. the present study highlights an experimental study carried out to analyze the effects of various FMCG welding parameter on weld width and tensile properties of weld metal extracted of a butt joint. The welding current, arc voltage and welding speed were chosen as variable parameters and due to high application in industry, welding assemblies were prepared from low carbon steel. The welding currents were chosen as 240,280,320 A, and arc voltage were chosen as 26,30 and 34 V and welding speed were chosen as 40,50 and 60 cm/ min for all experiments. The results of this study helps in selecting welding process parameters to achieve the desired geometry and tensile properties for weld quickly. **H R ghazvinloo (2010).**

CONCLUSION

Optimum parameter for mechanical properties for Air and Underwater welding of mild steel specimen of dimension 300x30x6 mm when current is 200A, voltage is 24V and electrode chosen is E6013, diameter 3.15mm. Underwater welding gives higher range of UTS Impact strength, BNS for same reading of variable parameter. Like at the welding speed of 147.7mm/min the BHN is 94.50 for Air welding but for underwater welding it is 110.34.

FUTURE SCOPE

If this investigation carries forward then we can compute what are the welding speeds and heat input rate if we need perfect strength of weld joint? In the present study we use manual metal arc welding (air and underwater), and find out the optimum values but when automatic welding machine will used for this purpose then better precision and accuracy may achieved in Butt welded joint as better control on voltage, current is possible.

In our study voltage and current is constant but if we want to variation in mechanical properties this constant voltage and current may vary. Due to variation in this input parameter we can get the different optimum value in different condition. These optimum values for different welding parameter can be used by welders directly for getting good strength of the welded joints . The mechanical properties is also vary by varying different welding parameter i.e. electrode size, bevel height and bevel height etc.

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