

IJEAST

INTERNATIONAL JOURNAL
OF ENGINEERING APPLIED SCIENCE
AND TECHNOLOGY

VOLUME : 2 ISSUE : 4 Print / Issue Publication Date: 31-Mar-2017

ISSN : 2455-2143

Indexed In

Google SCHOLAR OPEN ACCESS doi Crossref

WWW.IJEAST.COM

editor@ijeast.com

International Journal of Engineering Applied Sciences and Technology, 2017
Vol. 2, Issue 4, ISSN No. 2455-2143, Pages 178-180
Published Online February-March 2017 in IJEAST (http://www.ijeast.com)

A REVIEW ON UNDER WATER WELDING PROCESS

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Abstract: The paper describes principles of underwater welding and recent invention works undertaken for enhance welding technology and properties of underwater welds. Welding in offshore and marine and mechanical application is an area of research and understanding where, many problems are still unsolved. A brief classification of underwater welding is made, the principals involved and the advantages and disadvantages of the various types of underwater welding are described. Further discussion is made over the present conventional and some advanced techniques used. Finally, the scope of further research has been recommended. Welding in offshore and marine application is an area of research and understanding where, many problems are still unsolved. In the present paper, a brief description of the different commercial underwater techniques has been made. The problems in underwater welding have also been discussed in context to the existing welding techniques. Detailed description of a few advanced welding techniques has also been made. Finally, the scope of further research has been recommended.

Key words: Dry Welding, Wet Welding, SMAW, FCAW

I. INTRODUCTION

The fact that electric arc could operate was known for over a 100 years. The first ever underwater welding was carried out by British Admiralty – Dockyard for sealing leaking ship rivets below the water line. Underwater welding is an important tool for underwater fabrication works. In 1946, special waterproof electrodes were developed in Holland by 'Van der Willingen'. In recent years the number of offshore structures including oil drilling rigs, pipelines, and platforms are being installed significantly. Underwater welding is a type of welding which takes place in water.in under water welding, the environment around the welder is wet. And it will uses welding equipment's which has been set up for wet environment. Basically use the underwater techniques are hyperbaric enclosure welding, Main risks to doing underwater welding are the potential for electric shock, and the probability of producing arc mixtures of oxygen and hydrogen in pockets, which will be possible to set up an explosion, and there are three main types to perform underwater welding.

First is to build an enclosure, a large hole in the ground (pit), around the place of maintain and to pump away all the water: its amounts to ready the conditions for normal welding for Air, but the place may be deep under sea level. Second method of underwater welding containing to prepare an enclosure to be filled with Gas (Helium) under high pressure to push water back, and have the welder, fitted with breathing mask and other safe equipment, weld quite normally out of water but pressure will low.

The third and last wet underwater welding method, where no attempts are made to dry up the location of welding. Thus the power of the arc generates a bubble of mixtures of gases. Which will be the joining the metal plate more or less normally, using specially covered electrodes to ignore that too much hydrogen be absorbed in the weld.

II. CLASSIFICATION

Underwater welding can be classified as
1) Wet Welding
2) Dry Welding
In wet welding the welding is performed in the underwater.

III. WET WELDING

- Key technology for maintain marine structure.
- Welding is performed under water directly exposed to the wet environment.
- Increased the movement makes more effective, efficient and economical.
- Supply is connected to the welder via cables or hoses.
- Complete insulation of the cables and hoses are essential in case to prevent the chance for electric shock.
- Metal arc welding is commonly used process in the maintain of offshore platforms.

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A special electrode is used and welding is carried out manually just as one does in open air welding.

POWER SUPPLY USED: DC
POLARITY: -VE POLARITY

Dry welding:

*the chamber is created near the area to be welded and the welder does the job by staying inside the chamber.

*It produces high quality weld joints.

*The gas tungsten arc welding process is used mostly pipe works.

*Gas metal arc welding is the best process for this welding.

Dry welding in underwater may be achieved pressure is maintained at approximately one atmosphere by several ways

A. Dry Habitat Welding

Welding at ambient water pressure in a large chamber from which water has been displaced, in an atmosphere such that the welder/diver does not work in diving gear. This technique may be addressed as dry habitat welding.

B. Dry Chamber Welding

Welding at ambient water pressure in a simple open-bottom dry chamber that accommodates the head and shoulders of the welder/diver in full diving gear.

C. Dry Spot Welding

Welding at ambient water pressure in a small transparent, gas filled enclosure with the welder/diver in the water.

IV. CHARACTERISTICS OF A GOOD UNDERWATER WELDING

The characteristics of a good underwater welding process are:

(a) Requirement of inexpensive welding equipment, low welding cost, easy to operate and flexibility of operation in all positions.

(b) Minimum electrical hazards, a minimum of 20 cm/min welding speed at least.

(d) Permit good visibility.

(e) Produce good quality and reliable welds.

(v) Operator should be capable in supporting himself.

(vi)Easily automated.

V. APPLICATION OF UNDERWATER WELDING

The important applications of underwater welding are:

(a) Offshore construction for tapping sea resources,

(b) Temporary repair work caused by ship's collisions or unexpected accidents.

(c) Salvaging vessels sunk in the sea.

(d) Repair and maintenance of ships

(e) Construction of large ships beyond the capacity of existing docks.

VI. CONVENTIONAL UNDERWATER WELDING TECHNIQUES

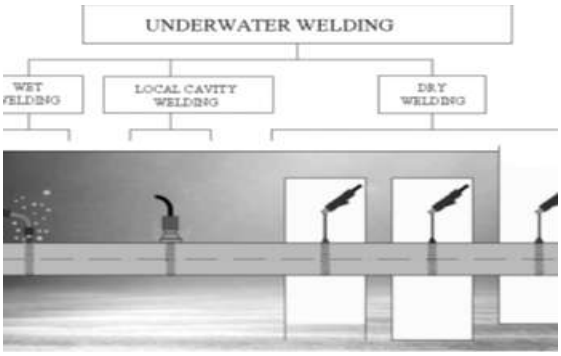
The fusion welding processes of greatest practical significance in underwater welding are manual shielded metal arc welding, tungsten inert gas welding, metal inert gas welding are used. The principles of the above mentioned welding techniques are summarized below:

6.1 Shielded Metal Arc Welding

Shielded Metal Arc Welding (SMAW) is among the most widely used welding processes. During the process, the flux covering the electrode melts during welding. This forms the gas and slag to shield the arc and molten weld pool. *Fig*ure shows the schematic of shielded metal arc welding process. The slag must be chipped off the weld bead after welding. The flux also provides a method.

VII. UNDERWATER WELDING TECHNIQUES

The classification of underwater welding techniques is presented.



Wet welding is performed at ambient pressure with the welder-diver in the water and no mechanical barrier between water and welding arc. Simplicity of the process makes it possible to weld even the most geometrically complex structures. The most commonly used wet welding technique is shielded metal arc welding (SMAW) and flux cored arc welding (FCAW) including self-shielded flux cored arc welding. Wet welding with coated electrodes is considered to be the most cheap and versatile method of operations in underwater environment. Wet welding with covered electrodes or FCAW is conducted directly in water environment down to

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100 metres. In water environment cooling rate in wet welds is much higher than in those obtained in dry welding. In the temperature range from 800 to 500°C it can change from 415 to 56 °C/s. This causes a loss of ductility of weld metal and of heat affected zone (HAZ).
Underwater wet welds are also known to contain high amounts of porosity. Porosity may be formed by molecular hydrogen, carbon monoxide or water vapour. Pores are present to some extent in all wet welds. The main factors affecting this phenomenon are: water depth, electrode covering and arc stability.

VIII. UNDERWATER WELDING – FUTURE SCOPE OF RESEARCH

Considerable research effort has been made to improve process performance and control strategies for the various underwater welding processes over the last half century. However, there are still many problems to overcome. The major efforts on research and development should be focused on the following topics:
a. Automation of the underwater joining and inspection of the welded structures.
b. Mechanized underwater welding for actual usage of a very large floating structures. c. Investigation of the potential of using a robot manipulator for underwater ultrasonic testing of welds in joints of complex geometry.
d. Application of advanced welding technique, like friction, laser welding and understand the behaviour of materials after the welding and process optimization. e. Invention of new welding. techniques and explore the possibility of its application in underwater welding. f. Generation of research data book on weld ability of materials during underwater welding.

IX. LITERATURE REVIEW

(1)Kunthlesh Kumar (Lecturer in mechanical Department); this Author has been described as the fact that electric arc could operate was known over a 100 years. The first ever underwater welding was carried out by British Admiralty – Dockyard for sealing leaking ship rivets below the water line.

(2) Jyotsna Dutta Majumdar (Department of Matallurgical &materials Engineering, IIT Khadagpur): It have been described as the classification of dry wet welding, dry welding in underwater may be achieved by several ways.

(3) J.Labanowski, D Fydrych, G Rogalski,(G U I): This Author has been described as the, classification of underwater welding techniques in presented in fig. and it will be the performed at ambient pressure with the welder diver in the water and no mechanical barrier between water and welding arc.

X. SUMMARY & CONCLUSIONS.

This paper presents the detail investigation of water welding process. Modern techniques of underwater welding give possibility of obtaining joints with sound welds that meets requirements of classification societies. Recent improvements in underwater welding have led to the increased use of wet and dry hyperbaric welding for marine applications. But more spread application of wet welding methods is limited due to common opinion of low quality of welds performed by various method. The general acceptance of underwater welding processes has been further advanced by the standardization of methods, procedures, and certification requirements provided by the American National Standards Institute and American Welding Society. In spite of many successful applications and results of investigations, underwater welding requires new research and development to achieve its full potential.

Kunthlesh Kumar & Rickramjeet Singh: States The Review On Under Water Welding Process.

1. **J. Labanowski, D Fydrych, G Rogalski (G U I**): States That The Underwater Welding Techniques In Fig**.**
2. **Jyotsna Dutta Majumdar, (IIT Khadagpur) :** Described The Underwater Present And Future Scope
3. **LYTHALL GIBSON :** Dry Hiperbaric Under Water Welding
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