TO STUDY THE EFFECT OF PROCESS PARAMETER ON GAS INTERRUPTION ON EN-10213-2 LOW ALLOY STEEL IN SMAW PROCESS

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Abstract- Shielded Metal Arc Welding (SMAW) technique applied to low alloy steel of ASTM grade EN-10213-2 which is frequently used in boiler and pressure vessel etc. Welding was carried out according to commercial practice under controlled welding conditions. For SMAW welding technique four work pieces were weld i.e. low heat input, lower medium heat input and medium heat input were examined by laco gas analyser.

During welding with SMAW shielding gas provides inert atmosphere which avoid other gas presented in air to be absorbed by weld pool. Yes some amount of gas absorbed by weld pool is always there. That put a big effect on mechanical properties i.e. impact strength. It is measured in ppm.Test result was carried out for different welded work piece for impact strength that explained the effect on welded workpiece.in this paper we will explained the effect of heat input on gas interruption properties and this gas interruption directly affect the impact strength of low alloy steel.

Under Non-Destructive testing ultrasonic and magnetic particle inspection test was done to check whether the welded piece is free from defect or not.

So the main objective of this research is to provide a suitable set on parameters to get a best possible weld with free from defects.

Keywords – Shielded Metal Arc Welding, Gas Interruption, Impact strength

I. INTRODUCTION

Welding is a process of joining two or more pieces of the similar or dissimilar materials to achieve complete coalescence. This is the only method of developing monolithic structures and it is often accomplished by the use of heat and pressure. Although in its present form it has been used since about the beginning of 20th century but it is fast replacing other joining processes like riveting and bolting. At times it may be used an alternative to casting. Thermo-chemical sources, the electric arc or some form of radiant energy can be used to melt the weld metal. In this process equipment must be capable of focusing the high-energy heat source on to the weld area. Presently welding is used extensively for fabrication of vastly different components including critical structures like boilers and pressure vessels, ships, off-shore structures, bridges, storage tanks, pipelines, missile and rocket parts, nuclear reactors, fertilizer and chemical plans, earth moving equipment and automobile bodies etc. Welding is also used in heavy plate fabrication industries pipe and tube fabrication. Shielded Metal Arc Welding techniques (SMAW) were applied to ASTM grade EN-10213-2 low alloy steel. Welding was carried out according to commercial practice under controlled welding conditions. For SMAW welding technique four work pieces were weld i.e. low heat input, lower medium heat input and medium heat input were examined by laco gas analyser

Shielded Metal Arc Welding (SMAW)

Shielded Metal Arc Welding (SMAW) or Stick welding is a process which melts and joins metals by heating them with an arc between a coated metal electrode and the work-piece. The electrode outer coating, called flux, assists in creating the arc and provides the shielding gas and slag covering to protect the weld from contamination. The electrode core provides most of the weld filler metal. The Stick welding power source provides constant current (CC) and may be either alternating current (AC) or direct current (DC), depending on the electrode being used. The best welding characteristics are usually obtained using DC power sources. The amperage needed to weld depends on electrode diameter, the size and thickness of the pieces to be welded, and the position of the welding. Generally, a smaller electrode and lower amperage is needed to weld a small piece than a large piece of the same thickness. Thin metals require less current than thick metals, and a small electrode requires less amperage than a large one. It is preferable to weld on work in the flat or horizontal position. However, when forced to weld in vertical or overhead positions it is helpful to reduce the amperage from that used when welding horizontally. Best welding results are achieved by maintaining a short arc, moving the electrode at a uniform speed, and feeding the electrode downward at a constant speed as it melts.

II. Proposed Work

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Materials and Methods

Shielded Metal Arc Welding (SMAW) techniques were employed on ASTM grade EN-10213-2 low alloy steel. Welding was carried out according to the commercial practice (described in ASME BPVC section IX) under controlled conditions.

Material is purchased with its inspection certificate (MTC) which includes the plate size, plate weight and its composition is according to the composition mentioned in ASTM (volume 1).

III. Experiment and Result

The material used in this study is a commercials grade of EN-10213-2 boiler and pressure vessel steel. Table 1 shows the chemical composition of steel used in this study.

Table1. Chemical Composition of Base Metal

Chemical composition % of grade EN-10213-2

C	Si	Mn	Ni	P	S	Cr	Mo	V	Cu
.18-.23	Max. .6	.5-1.2	Max. .4	Max. .03	Max. .2	Max. .3	Max. 1.2	Max. .03	Max. .3

*Joint Preparation:***-**A "Single Vee Butt Joint" is a common way to prepare thicker metal when a full penetration joint is required. A 60 degree V (30 degrees on each side) is ground into the two plates. A test piece of 150 X 150 X 19 mm, Groove angle 60˚ was prepared from a large plate of low alloy steel. Test pieces for welding were cut from a large plate and V groove of work piece has been made and using back plate, now at various process parameters welding of these pieces are done. The specimen for various Testing were cut from these welded pieces.

Required Amount of Materials

Number of samples required for different testing from welded plate as:
1. For Gas Interruption Testing a specimen of 4 mm diameter having length 10 mm. No. of specimen required one from each welded plate.
2. For Impact Strength testing a specimen 50 mm. in length and 10 mm in the width. No. of specimen required one from each welded plate.

Table2. Joint Detail

Type of joint	Backing	Backing Material Type
"V" Groove Butt joint	Yes	Base Material

Table3. Position of Weld

Position (s) of Groove	1G
Welding Progress	Horizontal

Table4. Technique of weld

Travel Speed	String or weave Bead	Multipass or Single pass	Single or Multiple Electrode (S)
Detail given below	Weave. (Weaving 4 X Ø of Electrode)	Multipass	Single Electrode

During the welding, process of welding, filler electrode, diameter of electrode and current type will remain same filler electrode was of moly herm of diameter 4mm and current type was DC/EP.

Introduction of Heat Input:-Heat input is one of the most important process parameters in controlling weld response. It can be referred to as an electrical energy supplied by the welding arc to the weldment. In practice, however, heat input can approximately (i.e., if the arc efficiency is not taken into consideration) be characterized as the ratio of the arc power supplied to the electrode to the arc travel speed, as shown in the following equation:

$\boldsymbol{Q = I * V * \frac{60}{v}}$ Where, I is welding current; V is welding arc voltage; v is the arc welding speed, Q is the heat input

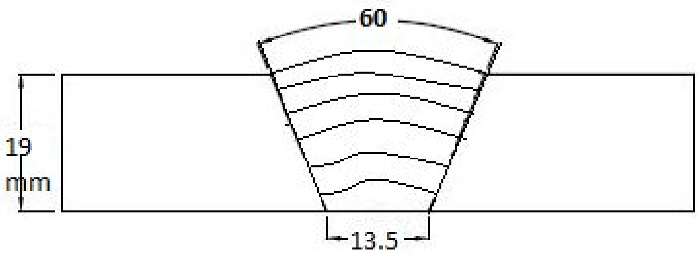

Figure 1.Schematic Diagram of Weld Metals

Table5. Observed Value of Travel Speed and Heat Input for Welded Test Piece as below:

Sr. No.	Welded Work Piece	Travel Speed (inch/min)	Heat input (KJ/mm)
1	Low Heat Input	5.13	1.57
2	Lower Medium Heat	6.11	1.79
3	Medium Heat Input	7.15	2.28
4	High Heat Input	8.04	2.99

Gas Interruption Analysis

During welding with SMAW shielding gas provides inert atmosphere which avoid other gas presented in air to be absorbed by weld pool. The principle of operation is based on fusion of a sample in a high-purity graphite crucible at temperatures up to, or in some cases exceeding, 3000°C in an inert gas such as helium. The oxygen in the sample will react with the carbon from the crucible to form carbon monoxide (CO); nitrogen is released as molecular nitrogen (N_2). Oxygen is detected either as carbon dioxide (CO_2), CO or both, using infrared (IR) detection. Nitrogen is determined using a thermal-conductivity (TC) cell. Results were analysed in ppm.

Table6. Gas absorbed value for LHI, LMHI, MHI & HHI

Test Piece	Travel	Heat input	Gases Absorbed(PPM)

	Speed(inch/min)	(KJ/mm)	Nitrogen	Hydrogen	Oxygen
LHI	5.13	1.57	22	1.09	846
LMHI	6.11	1.79	20	.99	660
MHI	7.15	2.28	16	.89	550
HHI	8.04	2.99	12	.82	330

Gas Absorbed V/s Welding Variable

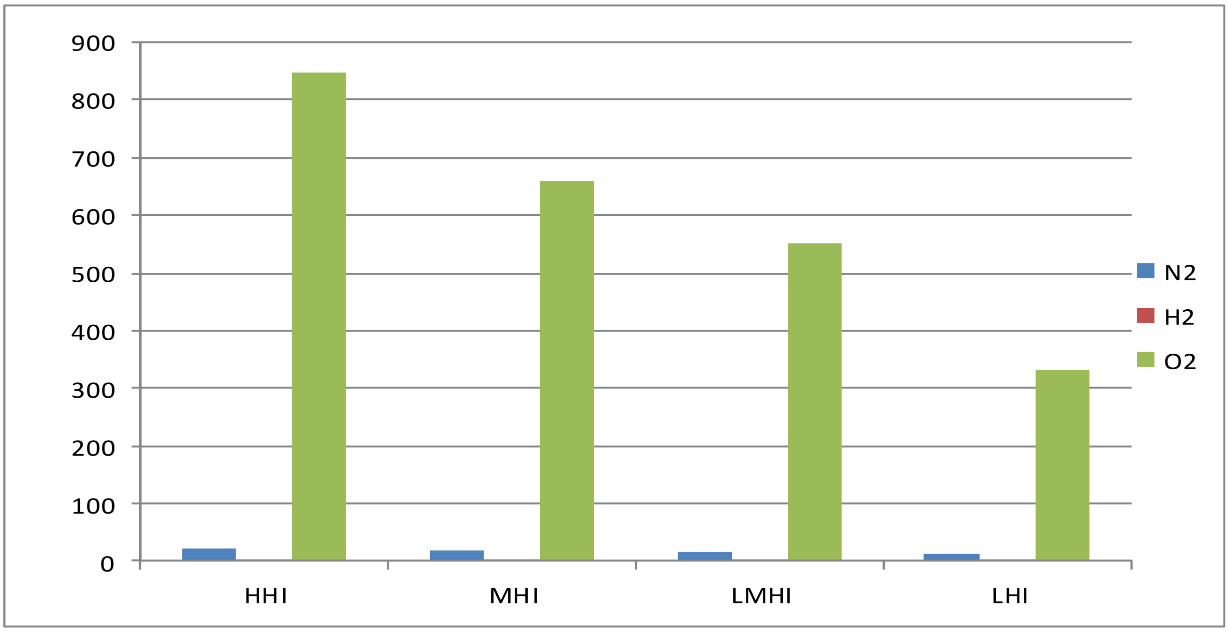

Figure 2. Graph B/W Gas Absorbed in Weld Metal and Welding Variable

Impact Strength Analysis-Charpy Test

Table7. Charpy Test Result

Test Piece	Impact Test harpy J /cm^2
LHI	180
LMHI	162
MHI	86
HHI	76

IV.CONCLUSIONS

In the present work, it is concluded that:
1. It can be seen from observation table and graph for gas interruption analysis, when heat input value increases the absorbed value of gases decreases. From observation we can see that when heat input value for low heat input work piece is less and absorbed gases value are more and as increasing the value of heat input from low heat input to lower medium, Lower medium to medium and medium to high heat input work piece there is continuously decreasing in gas absorbed value.
2. From the impact strength analysis it can be seen that there is a direct effect on impact strength of gas absorbed value. When heat input is less and gas absorbed value is more, there will increases impact properties. As further increasing of heat input, the gas absorbed value less and impact properties decreases.

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