The effect of voltage on weldment size cold rolled steel sheet joint using low arc joining technology

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ABSTRACT – The present trend in the fabrication industries is the use of automated welding processes to achieve high precision and to increase the rate of the productivities. ColdArc welding is a modification of the short-circuit transfer mode for thin plate requirements. The main objective from this experiment is to identify the effects from the parameters in sizing the weldment which is normally related to voltage on cold rolled sheet plate joint. It is found out that, this kind of joint design and geometry shows good value in weldment reinforcement. It has been proven that increasing the voltage values will increase the bead width size.

1. INTRODUCTION

Welding is a joining process involving interactive parameters. It is very complex due to its important effect to the quality of the weldments. The relationship between arc welding parameters and weld bead geometry is distinguishable since a number of factors are involved [1].The voltage is consider as a deciding factor for the shape of the weld bead .Constantly the voltage results in flatter ,wider, and reduction on penetration. This reduction leads to reduction on porosity which is caused by rust on steels. Increasing the arc voltage up to the optimum value leads to an enhanced loss of alloying elements. Undoubtedly this will affect the metallurgical and mechanical properties of the weld metal [2].

ColdArc is a new variation on low arc energy technology welding that introduces changes in order to improve the quality and the productivity of the welding performance. The flexibility of the process of automatization using welding robots is vital. Therefore, the heat input can cause several issues in distortion and without a doubt residual stresses has become a priority in welding industry.

With the intention of protecting the quality and the cost, the use of light material has become an interest among industries. It has been proven that Cold rolled steel sheets is benefited and offers variety of outstanding properties in our everyday items mostly in automobiles and daily home appliances [3]. It was found that Cold Rolled Steels presents perfect thickness to the plates as well as it presents flatness tolerances, surface finish and press formability. The quality of weldment size can be developed by controlling the parameters and its processes. The size of the weldment is expected to be suitable when the bead formation is adequately acceptable. Mainly the characteristics of weld bead are often assessed by bead geometry, and it is mainly influenced by heat input [5].

2. METHODOLOGY

The robot welding used in this study was KUKA type KRC4 and the system is equipped by EWM ColdArc power source. The material plate is JIS G 3141 Cold rolled carbon thickness 0.5 mm steel sheets performed on straight bead weld along 200 mm . Solid welding wires grades ER70S-6 for mild steel with diameter 1.0 mm and gas mixture 82 % Argon + 18 % CO2 was employed in the process. The experiments were tested according to the data obtained from the literature review [4] and it was guided by using the welding parameters given in [5]. The process of the parameters is presented in Table 1.

Table 1 Welding Parameter

	No. of Sample							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Welding speed (m/min)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Ampere (A)	30	30	30	30	30	30	30	30
Voltage (V)	5.6	6.6	7.5	8.6	9.6	12.6	13.6	14.6

3. RESULTS AND DISCUSSION

The standard for welding quality and the welded joints can be classified according to uniform and regular joint EN ISO 5817. A schematic of the weld deposit area is illustrated in figure 1. These figures showed the fusion zone, also known as the weld metal (A). The fusion zone experiences melting and solidification, and its size are the focus of this paper. Part B is a penetration area.The voltage principally determines the shape of the weld bead size cross section and its external appearance. Furthermore, increasing the welding voltage with the constant and the current welding speed produces flatter, wider and less penetrated weld beads result. Higher voltage also bridges an excessive root opening when fit-up is poor. An addition in increasing the voltage increases the possibility of breaking the arc and disrupting the normal welding process. Mechanical and metallurgical properties of the weld metal will be affected when increasing the voltage. It will also enhance the flux

consumption which increases pick up or loss of the alloying elements.

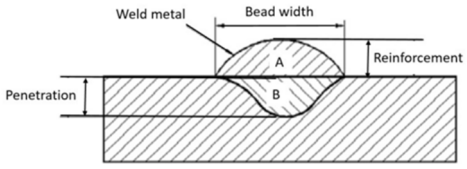

Figure 1 Weld bead geometry characteristics[2]

Table 2 Reinforcement and bead width measurement

Voltage (V)	5.6	6.6	7.5	8.6	9.6	12.6	13.6	14.6
Reinforcement (mm)	0.8	0.6	0.8	0.8	0.8	0.9	1	1
Bead Width (mm)	1.5	1.8	2	2	2.1	2.1	2.11	2.11

An overview of table 2 showed the result of the reinforcement and bead width measurement. Visual examination illustrated that unequal cladding of weld bead width occurred. Increasing voltage from 5.6 V to 14.6 V influenced the increasing bead width from 1.5 mm to 2.11 mm. Formally the voltage affected the weld bead width on ColdArc technology. However, the voltage values of 10.6 and 11.6 are not performed since the researcher conducts randomly pre-trial experiments.

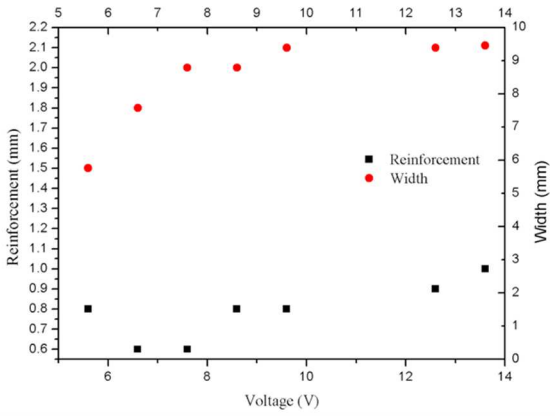

Figure 2 The effect of welding voltage on reinforcement and bead width

As shown in figure 2, the effects of welding voltage on reinforcement and bead width size. The results showed is significantly affecting on the reinforcement and bead width weldment. Interestingly, there were also correlated with the results obtained by previous researcher [6].The reinforcement of weldment size point (0.8 mm to 1 mm) increase once the voltage is increase (5.6 V to 14.6 V) However, the results does not uniform the reinforcement size with the decrease at point 1.8 mm when the voltage is 6.6 V.

Low arc welding is considered to be sound and economical if it has a minimum bead width, reinforcement and dilution. Welding voltage has influence on bead width and reinforcement Arc stability because of the efficient heat transfer and reduction of arc wander. An excessive weldment was not noted from this experiment results. The low arc joining process proves to be suitable for welding thin sheet metal. It is essential to determine the right welding speed and currently to minimize the distortions in the product in constant.

4. CONCLUSION

The most significant findings from this study is that reinforcement and bead width of weldment size is related to voltage on cold rolled sheet plate joint. After completing this work, several conclusions are made from the results shown above.

1) When voltage increases, the weld bead width and reinforcement size will increase.
2) Size weldment is initially increasing and moving linearly when it reaches high voltage
3) The larger quantity of molten weld material in bead-on-plate welding will results in higher voltage when increasing in weld bead width. In this case it is higher due to the spread of weld material on base plate by good wetting than reinforcement height and depth of penetration.

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