SETTING THE WELDING PARAMETERS IN ORDER TO OPTIMIZE THE WORKING INTERVAL OF THE WELDING PROCESS

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ABSTRACT: The paper presents a solution for optimizing the electric arc welding process by modifying in small steps one of the parameters of the welding regime: the tension of the electric arc welding, for corner-welded joints. Accurate knowledge of the value range of a welding parameter leads to the avoidance of stress concentrators that may occur but also to defects in welded joints.

KEY WORDS: welding parameters, corner welds, working interval, optimize.

1. INTRODUCTION

Generally, welding practice focuses on how to optimize the setup parameters within the recommended working range.
Success in solving any optimization problem is strongly influenced by a correct mathematical representation of the optimization system in terms of the dependence between the optimization criterion (performance function) and the variables to be optimized. If the process be studied is of a high complexity, the approach is very difficult [1-3].
For this reason, the breakdown of an optimization problem for systems with high complexity structures, such as technical systems, into optimization problems of some subsystems of that system, usually has important advantages for solving the optimization problem [1-3].

2. CASE STUDY

In the case of corner welds, when welding S 235 steel plates with a thickness of 5 mm, in a horizontal position with stresses at the upper limit of the operating range, due to the relatively long arc, a defect occurs in the form of a cut at the vertical leg of the base material, which cannot be prevented, (Figure 1 on the left). In addition, the welding bath will slide into the welding joint along the horizontal plate [4-6].

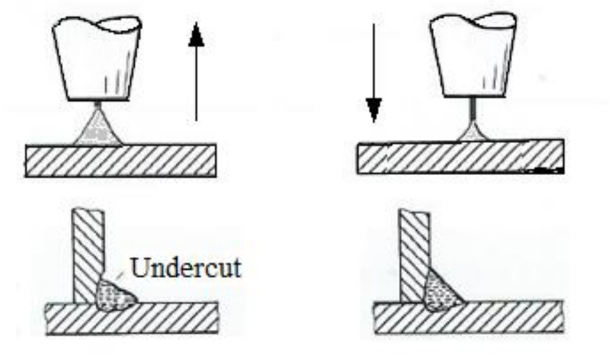


Figure 1. Effect of voltage in horizontal-vertical fillet welding .[6]

Table 1.

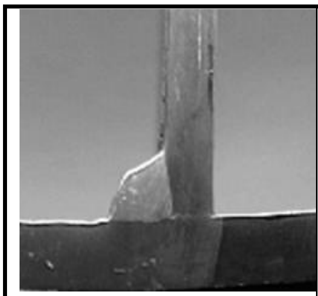
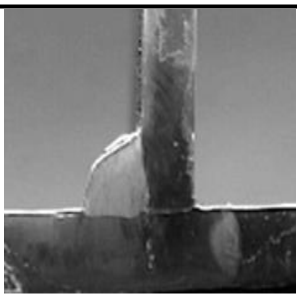
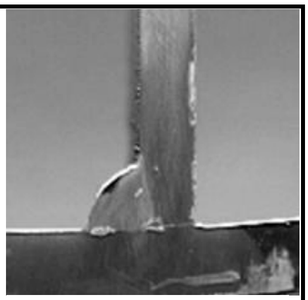
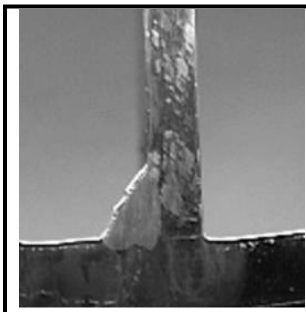
		
Ua=19V	Ua=20V	Ua=21V

Table 2.

		
Ua=24V	Ua=26V	Ua=28V

In the experimental program, corner welded seams were made on sheet metal components with thicknesses between 3… 6mm [7].

Six small-step measurements of the welding arc tension were performed in order to observe its influence on the appearance of the welded seam, it being known that these main welding parameters favorably or not influence the quality of the welded joint [8].

In Tab 1 are given the shape of the welded seam for low voltages of the electric arc and in Tab 2 are given the aspects of welded seams for high voltages.

Weld a butt or filled weld in flat position so that the weld pool cannot run off. With a higher fluidity resulting from a higher voltage level, the external shape of the weld is broader and less convex.

A higher arc voltage, and upper limit of the working range, gives the desired result, as in Figure 2 [6].

It can be seen that hight arc voltage makes the weld pool more fluid and lower voltage makes the wold pool more viscous.

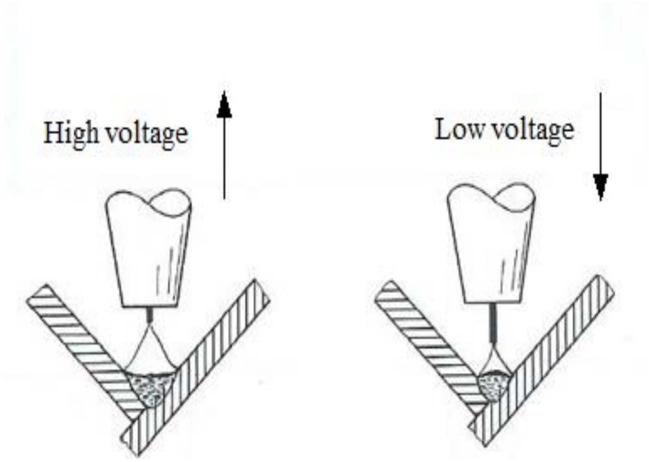


Figure 2. Effect of voltage. Filled weld flat position

3. OPTIMIZATION WITH SMALL STEPS

In order to determine as accurately as possible, it was necessary to take into account the following factors:

- Basic material;
- Additive material;
- Welding equipment;
- Technological conditions for the execution of tests;
- How to choose the measured quantities [9], [10].

Weld a fillet, throat thickness 5 mm, in horizontal position, using a spray arc with high deposition rate. Weld the first half at a high voltage.

Without interruption of the operation, reduce the voltage to the lower limit of the working range for the second half.

The same fillet weld in flat position. Again, begin at the upper limit of the range at high voltage and go down to the lover limit while continuing to weld.

An important point in the optimize is to recognize the effect of proper voltage settings as well as improper ones. In this case, both the upper and lower limits of the working range can be exceeded, science this will make the evaluation clearer [11].

The chemical properties of the shielding gas influence its metallurgical behavior, as well as the welding surface.

Thus, for example, the presence of oxygen leads to the burning of some alloying elements, and to the increase of the fluidity of the bath by decreasing its surface tension. An atmosphere containing carbon dioxide has the effect of a carbon alloy to the welds, and at the same time, an increase in the seam overheating.

The most used mixture is Corgon, compared to the one obtained in the case of using only carbon dioxide, when a higher lateral penetration is obtained than in the first case.

The mathematical calculation model of electric arc welding technologies is based on three statistical relations [12]:

$$I_s = f_1(d_e),\ U_a = f_2(I_s),\ A_D = f_3(I_s) \qquad (1)$$

Relationships (1) are deduced by statistical regression and vary from one welding process to another.

3. CONCLUSION

In fully mechanized welding, controlling the arc length by changing the wire feed rate while holding the travel speed constant would result in a change in welding current, penetration, metal deposition rate, and thus weld volume.

The change in arc voltage led to the following conclusions:

- It is observed that the tension of the electric arc Ua acts on the width of the seam b, in the sense that with the increase of Ua also increases b, the other geometric elements being insignificantly influenced. [4]
- The seam width increases linearly with Ua, and the overhang h decreases linearly with Ua.
- In order to obtain a stable arc and ensure a metal transfer with minimal splashes, there must be an optimal correlation between the

two main welding welding parameters and the arc voltage, known by the relation:
The relationship is valid in the case of CO_2 welding.
- The decrease of the wire feed speed, by the implicit decrease of the welding current, in optimal form determines the increase of the tension by decreasing the penetration and reciprocally, the increase of the wire feed speed, determines the reduction of the tension by shortening the arc length and implicitly without a visible increase in penetration due to the flow of the bath in front of the electric welding arc. [2], [3].
In electric arc welding the primary technological parameters (welding current Is, arc voltage Ua, and welding speed vs) are decisional variables.
The welder can give any values to these parameters and, even during welding, can change their sizes.
The problem of optimizing the welding processes lately preoccupies an increasing number of specialists engaged in the activity of obtaining an increased quality of the executed products at a more competitive price and responding to more and more restrictive production conditions. from the point of view of environmental protection.

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