THE INVESTIGATION OF A BUTT WELD WITH ULTRASOUND

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Abstract: *In the case of welded joints there are defects that can not be seen with the naked eye. These defects being within the material to know if they can cause failures in the future, should be investigated and ranked in an acceptance class according to certain standards in the field. In this paper we investigate using the ultrasonic control method, the welding seam between two butt welded sheets.*

Keywords: Investigation method, ultrasound, butt welded joint

1.INTRODUCTION

The ultrasonic control method is a non-destructive defectoscopic method.

The defectoscopy is a set of physical tests that show defects from the material phase, the semi-finished product, after the machining, to the finished part phase, reaching to the assembly and subassemblies phase or even in the operational phase.

Ultrasounds are mechanical vibrations with frequencies between 16 kHz and 10 14 Hz.

Through the ultrasonic control method, all categories of metallic and non-metallic materials can be controlled.

By this method, it is possible to reveal all categories of defects, especially interior ones.

The ultrasonic control method is useful because it highlights internal discontinuities that can cause serious damage [1-2]. The ultrasonic investigation is also applied after the reconditioning of the parts, in order to detect any discontinuities that could be added further after reconditioning [3-5].

2. EXPERIMENTAL RESEARCH

In the paper is presented an ultrasonic investigation of the butt welded joint which is shown in Figure 1.

The material from which those two sheets are made is a general purpose steel, with the symbol S 235 JR, according to EN 10028-2, whose chemical composition is shown in Table 1.

The mechanical characteristics of the material from which the welded piece is made are shown in Table 2.

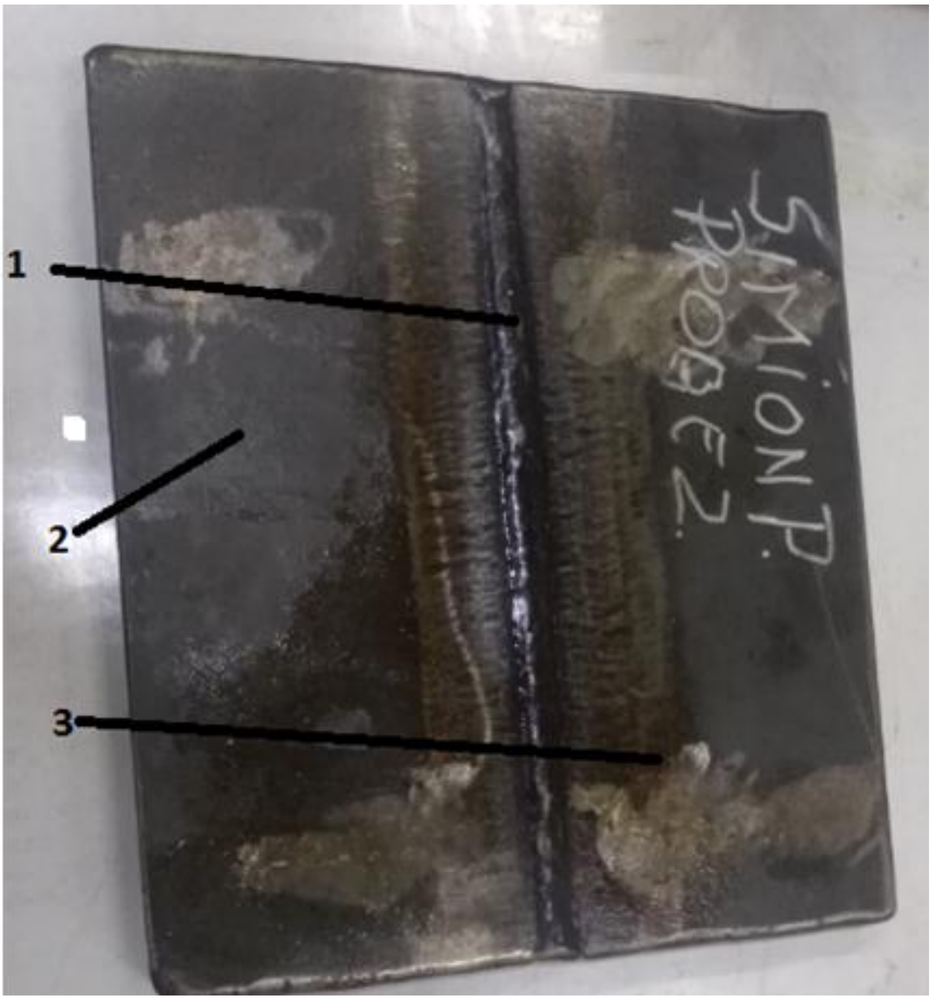

Figure 1 The welded sample subjected to ultrasonic control
1-welding seam; 2 and 3-butt welded sheets

Table 1. Chemical composition of the base material

Base material	Chemical composition %					
	C	Mn	P	S	Si	Other elements
S235 JR	0,18	0,80	0,050	0,050	-	-

Table 2 Mechanical characteristics of the base material

Base material	Mechanical characteristics					
	R_m (MPa)	$R_{p0,2}$, (MPa)	A, (%)	KCU_{min}, (J/cm^2)	T (^0C)	KV_{min}, (J)
S 235 JR	360-440	240	23	-	-	27 + 20 ^{0}C

The ultrasonic investigation of the butt welded sheets was made with the USM 35 X defectoscope, shown in Figure 2 [6].

This defectoscope is designed to investigate the discontinuities of various industrial parts. The device is portable and can be used in the laboratory as well as in the field.

The use of the defectoscope is only made by qualified personnel. The defectoscope is complex, it includes in its construction several elements that must be known by the operator. From the description of the defectoscope, from the general view we can list the following elements:

1-on / off key
2-key to select function groups
3-key to select the operating level
4-key to record data
5-key for data transfer
6-key for enhanced playback of the signal area
7-key for oscillogram capture
8-button rotary to adjust the amplitude of the signals
9-key for setting the amplitude variation step
10-area network and data transfer jacks
11-connectors for connecting the sensors
12-warning lights
13-key to select functions
14-button rotator for assigning function values
15-area dialog or data display

The program used by the device is designed on three levels of operation. Each operating level has five function groups, each group containing four functions. Operating levels are marked with digits 1; 2 and 3, shown after the first function group.

The selection of the operating levels is done by pressing successively key 3.

Selecting a specific group of functions within an operating level is done by pressing one of the keys 2.

Selecting a function within a function group is done by pressing one of the keys 13.

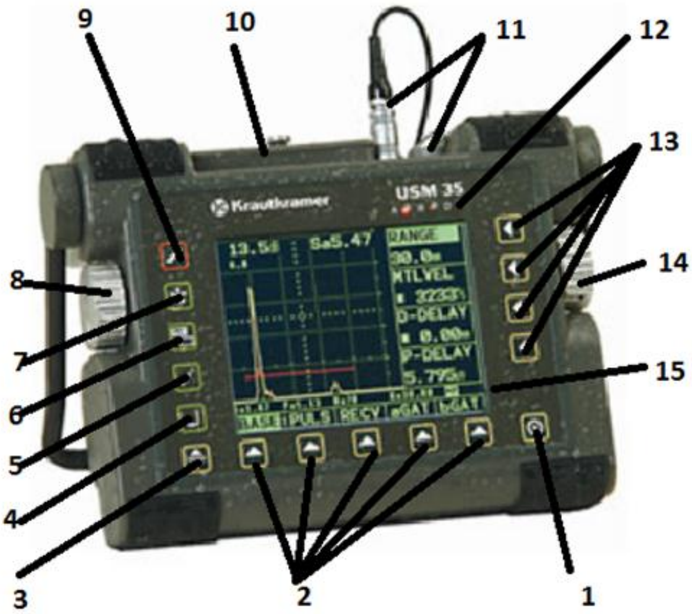

Figure 2 Ultrasonic Defectoscope USM 35 X

In the first phase, the ultrasonic control is started using the longitudinal wave probe.

The piece control begins with the calibration of the defectoscope with the block of calibration A1, as shown in Figure 3.

After the calibration, the ultrasound control is done on the right side of the piece, along the longitudinal wave examining area, using the MB 4S probe, as shown in Figure 4.

Then we will go to the left side ultrasound control, along the longitudinal wave scan area, using the MB 4S probe, similar to the left-hand control, as shown in Figure 5.

In the second phase, the ultrasonic control is performed using a MWB 45-2 (2 MHz) inclined touch probe.

The second phase starts this time with calibration with the transversal touch probe, as seen in Figure 6.

Then, follow the control itself with the inclined touch probe, as can be seen in Figure 7.

Figure 3 Calibrating the defectoscope with block A1

Figure 4 Ultrasonic examination with longitudinal waves on the left side of the joint

Figure 5 Ultrasonic examination with longitudinal waves on the right side of the joint

Figure 6 Calibrating the inclined transducer waveguide defectoscope

Figure 7 Controlling the specimen itself using an inclined transducer waveguide defectoscope

3. EXPERIMENTAL RESULTS

Figure 8 Detection of the discontinuity

As can be seen in Figure 8, we are dealing with a crack discontinuity.

4. CONCLUSIONS

The defect is a 49.4 mm long crack at a depth of 9.41 mm.

This defect has to be removed by air arc gouging, but this is the subject of another paper.

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