INVESTIGATION OF A FILLET WELF JOINT WITH ULTRASOUND

PhD. Claudiu BABIS,Faculty of Engineering and Management of Technological Systems „Politehnica ” University, claudiubbs@gmail.com
PhD. Oana CHIVU, Faculty of Engineering and Management of Technological Systems „Politehnica ” University, virlan_oana@yahoo.co.uk
PhD. Andrei DIMITRESCU, Faculty of Engineering and Management of Technological Systems „Politehnica ” University, andrei_dimitrescu@yahoo.com
PhD. Loredana DASCALU, Faculty of Ensgineering and Management of Technological Systems „Politehnica ” University, Dascalu_loredana_cristina@yahoo.com
PhD. Elisabeta BANICA, Theory of Mechanisms and Robots Department „Politehnica ” University, Bucuresti, Romania, banicaelisabeta29@yahoo.com

Abstract: *Fillet welded joints have a very high share in the industry. In the case of these welded joints, the stress concentrators at the intersection of the base material / filler material and the inner discontinuities are specific. The cumulative effect of these stress concentrators and the interior defects that inevitably occur in welding can lead to failure that may result in unpleasant consequences. Therefore, in the case of fillet welded joints, it is necessary to monitor and control the inner discontinuities. In this paper we investigate using the ultrasound control method, the fillet weld seam between those two T-welded sheets.*

Keywords: Investigation method, ultrasound, fillet welded joint

1.INTRODUCTION

By the ultrasound control method, interior discontinuities can be highlighted, detecting the depth of the defect but not its shape. In order to be able to highlight the shape of the defect, we need to use other methods of non-destructive defectoscopy, such as penetrant radiation defectoscopy.

The ultrasonic control method has a very high sensitivity, with little noticeable defects of micron ordinal magnitudes.

Due to the high penetration power of ultrasounds, this method can show obvious defects with depths between 5 and 20 meters.

Due to the very high sensitivity of the ultrasonic control method, some false noise signals can be generated. Therefore, as mentioned above, other complementary methods of investigation, such as penetrating radiation control methods, can be used to increase safety in interpreting the results.

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 fillet 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.

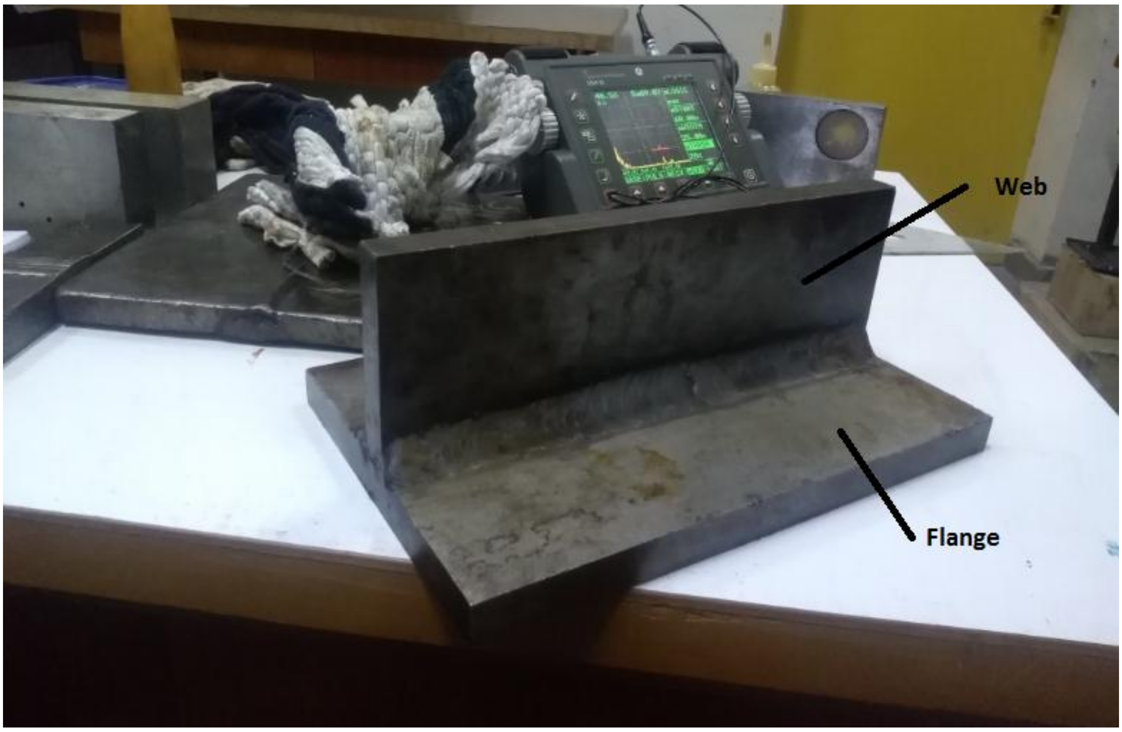

Figure 1 The frillet welded sample subjected to ultrasonic control

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 ^0C

The ultrasonic investigation of the fillet welded joint 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.

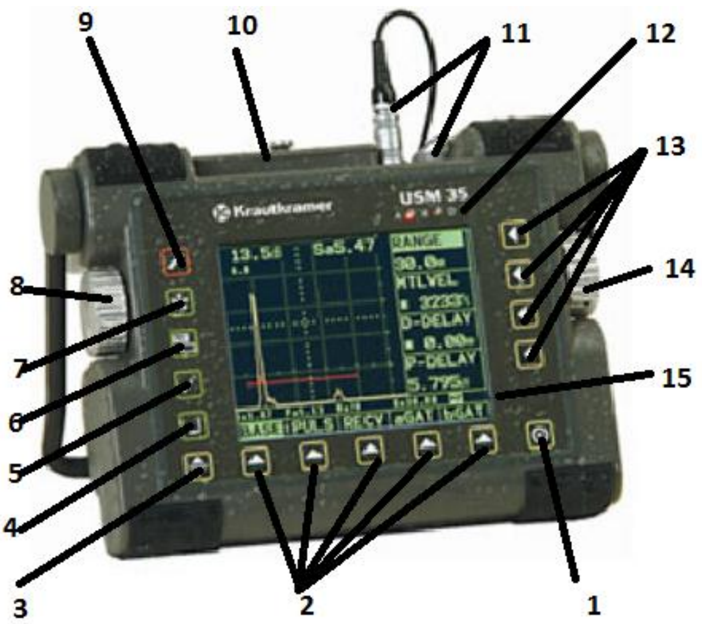

Figure 2 Ultrasonic Defectoscope USM 35 X

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

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

After calibration, it follows the investigation of the fillet welding joint with the longitudinal wave probe, on the web side, to highlight the lack of penetration defect, as shown in Figure 4.

It is then passed to the ultrasound control to make evident the lack of penetration defect on the other face of the fillet welded joint, i.e. on the flange joint, as shown in Figure 5.

In the second phase the ultrasound control of the fillet welded joint is performed using a MWB 45-2 (2 MHz) inclined probe.

In the second phase it is also started this time by calibrating with the transversal touch probe, as seen in Figure 6.

Next, the flange is examined on the width of the examination area.

Then there is the actual control with inclined probe, as seen in Figure 7.

Figure 3 Calibrating the defectoscope with block A1

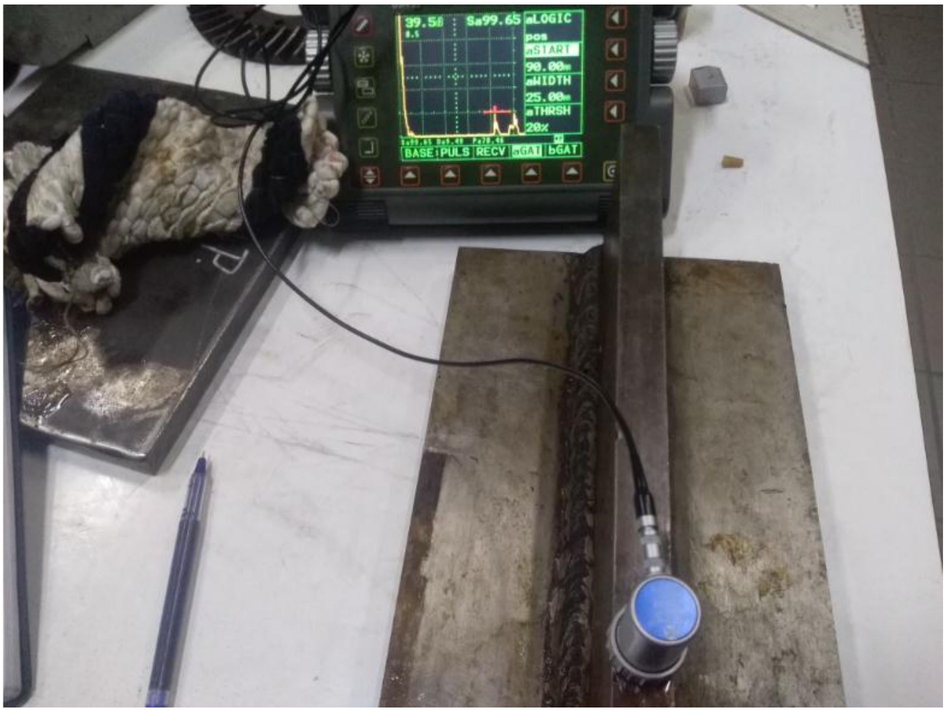

Figure 4 Ultrasonic examination with longitudinal waves on the web of the fillet welded the joint

Figure 4 shows that a defect at the depth of 99.65 mm is evident.

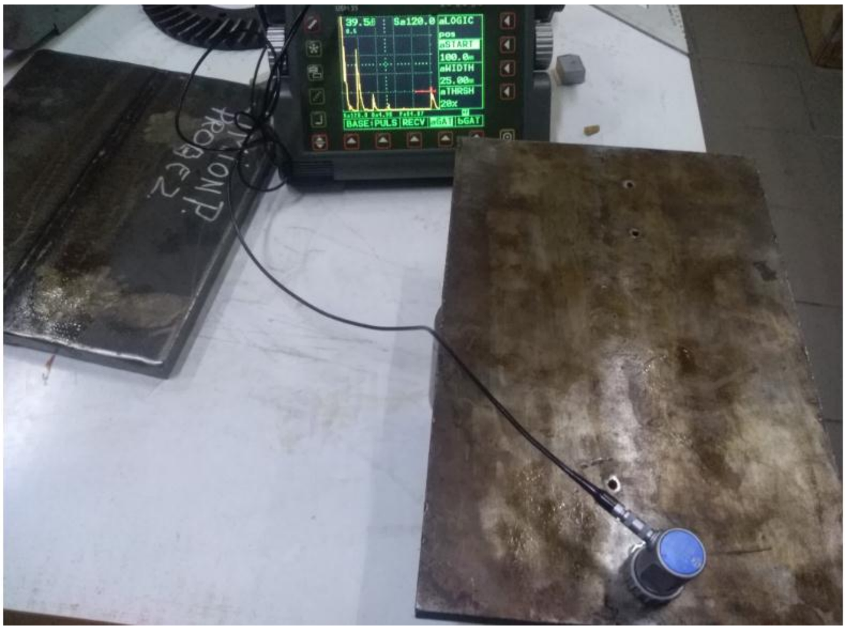

Figure 5 Ultrasonic examination with longitudinal waves to highlight the lack of penetration on the flange side of the fillet welded joint

The repetitive echoes shown in Figure 5 between the input and the bottom signal, clearly show that there is a lack of penetration defect.

Figure 6 Calibrating the inclined transducer waveguide defectoscope


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

3. EXPERIMENTAL RESULTS

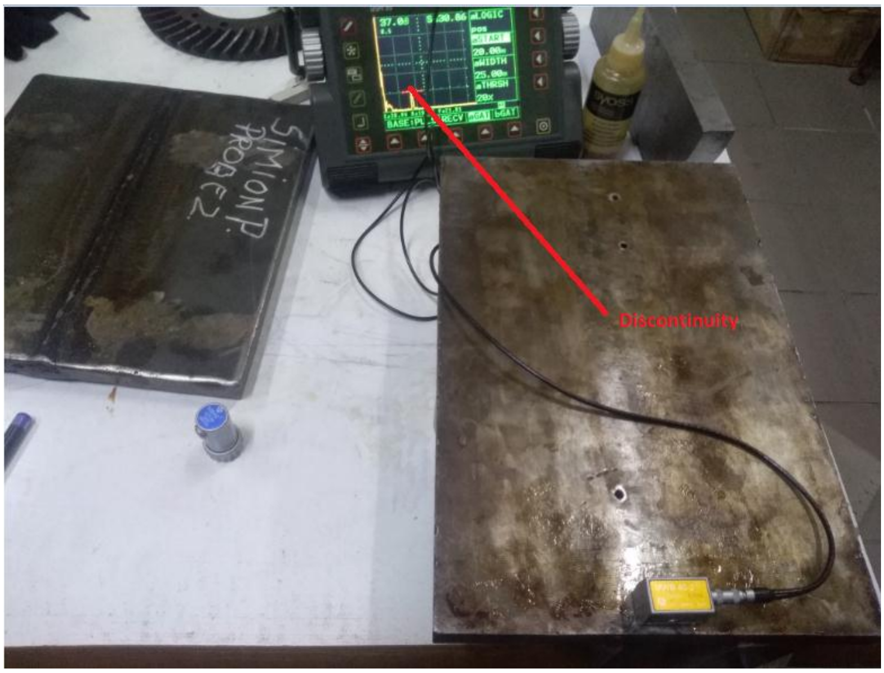

Figure 8 Detection of the discontinuity

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

4. CONCLUSIONS

The defect highlighted is a crack located in the welded joint flange at a depth of 18 mm.

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

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