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ANALYSIS OF QUALITY OF WELDED JOINT ACHIEVED WITH FLUX CORED WIRE IN PG WELDING POSITION

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Abstract: Stable boxy reservoirs, due to a better degree of utilization of space, are increasingly replacing cylindrical tank. In processing are used the technologies of plastic deformation and welding. How for production of tanks are used small thickness sheet metals, in welding process is necessary to enter minimum quantity of heat to ensure good welded joint. Through the work we analyze the comparative quality technological test of the weld achieved of MAG welding with the use of solid wire and flux cored wire in the PG welding position.
Keywords: welding; PG position; flux cored wire

1. INTRODUCTION

Welding includes production of a compound which is inseparable bond of two metal parts, wherein at the metal continuity. In manufacturing of the tank, the welds required < tightness and higher ductility of the welded joint. For a particular type and thickness of the base metal to weld for high quality in terms of: functionality, dimensional accuracy, aesthetic appearance and corrosion resistance, previously we must define the welding technology, which includes a selection:

- welding procedure,
- additional and auxiliary materials,
- protective atmosphere,
- welding position,
- welding parameters (diameter filler metal, welding current, speed of wire, welding speed, diameter of the diffuser gas flow of shielding gas, the length of contact guides, arc length,)
- welding techniques (slope torch, welding direction, swinging port)
- preheating and intermediate heating,
- welding sequence and a thermal treatment.

Since the welding is a complex process, and the geometrical characteristics of the weld quality significantly affects a change in any of the above parameters.

2. INFLUENCE OF POSITION WELDING

Choosing a location welding significantly affect the choice of welding procedure and all other welding parameters. Depending on the type of base material (or tube sheet), according to EN ISO 6947, welding can be carried out in the following nine Welding positions: - passed; PB - horizontal; PC - a horizontal vertical; PD - horizontal overhead; PE - overhead, PF - vertical up, PG - a vertical downwards, PH - the tube upwards; CS - the down pipe. When welding in a fixed position, such as PG, due to a possible runoff melt, welding is performed high speed welding and much lower heat input in the weld in comparison to PA position.

MAG welding process is a manual welding process that has the highest productivity and it is most used in welding sheets of carbon steel.

The application of cored wires for welding method should be similar to the other welding parameters, (the slower the cooling the melt) to give a better quality welding (about equal to the greater strength and ductility) in relation to the application of full wire.

Along the same other parameters welding torch inclination and welding speed significantly affect the penetration depth and the width of the weld. This means that depending on the techniques the amount of heat input into the unit section weldment different.

The analysis of geometrical properties and mechanical properties of the weld generated in the PG position welding, and welding the same parameters, and using the cored wire filled with the welding method.

3. SELECTION OF MATERIALS AND WELDING PARAMETERS

The basic material is steel sheet quality S235, thickness 3 mm with a maximum content of: 0.22% C, 1.6% Mn, 0.05% Si, 0.05% P, 0.05% S, and Re = 235 N/mm^2 and Rm = 360-510 N/mm^2.

Shielding gas: argon and a mixture of two component in a ratio of 82/18 CO_2 labeled M21 to EN ISO 14175.
Additional material:

» cored wire: OK E71T-1, Brand ESAB
» solid wire: OK Aristorod 12.50, Brand ESAB

Table 1. Chemical composition and mechanical properties of cored wire: OK E71T-1, Brand ESAB

Cover – Type of electric current classification		Chemical composition Model %	Mechanical properties Metal welding Model	Application Areas	Ø mm
AWS A5.36: EN 17632-A:	E71T1-C1A0-CS2-H4 E71T1-M21A0-CS2-H8 T 42 2 P C 1 H5 T 46 2 P M 1 H10	0,05 C 1,20 Mn 0,54 Si 0,013 P 0,020 S	Re: 530 N/mm^2 Rm: 580 N/mm^2 A5: 25% KV: 125J: - 20°C	Rutile wire, used with multi-purpose alloys and CO_2 gases in all conditions. Shielding gas: CO_2 or Ar/CO_2 mix., DC +	1,2

Table 2. Chemical composition and mechanical properties of solid wire: OK Aristorod 12.50, Brand ESAB

Cover – Type of electric current classification		Chemical composition Model %	Mechanical properties Metal welding Model	Application Areas	Ø mm
AWS A5.18: EN 14341-A:	ER70S-6 G38 2 C G3Si1 G 42 4 M G3Si1	0,08 C 1,20 Mn 0,65 Si 0,013 P 0,012 S	Re: 470 N/mm^2 Rm: 560 N/mm^2 A5: 26% KV: 90J: - 20°C	Bare Mn-Si-alloyed solid wire for the GMAW of non-alloyed steels. Shielding gas: CO_2 or Ar/CO_2 mix., DC +	1,2

Welding performed in butt welding position PG of a compound of the metal sheets 3 mm thick and 300 mm length of the weld, the protection of the 82/18 mixture of Ar / CO_2 and

» cored wire: I = 207 A, t = 26 s, spacing 0.5 mm
» solid wire: I = 228 A, t = 23 s, spacing 1.0 mm

4. TESTING PROPERTIES OF WELDED JOINTS

Monitoring performance of welded joints is made by:

» visual control of face and root seam as well as macro-metallurgical cross section,
» tensile tests.

Visual control

Visual inspection of the samples welded by selected welding parameters included an examination of weld face and root and macro-metallurgical cross section where is noted:

» the sample welded cored wire: unequal face suture, incomplete provar roots with partial tune-up one side of the seam and adhesive tape (no penetration) on the other hand, shown in the Figure 1,
» the sample welded wire full depression visible faces mid seam, to cracks roots side seam, and voids caused by gas bladders, Figure 2,

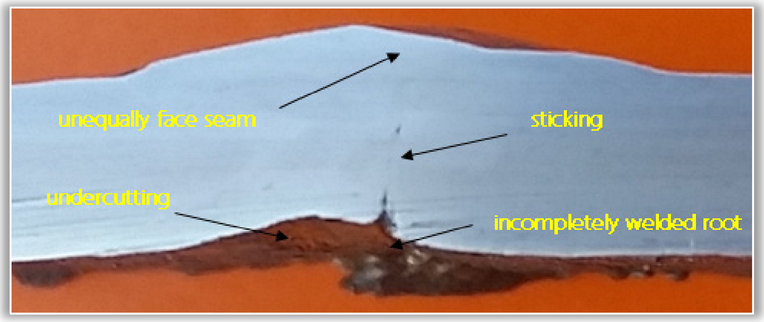


Figure 1. Macro-sectional sample welded cored wire

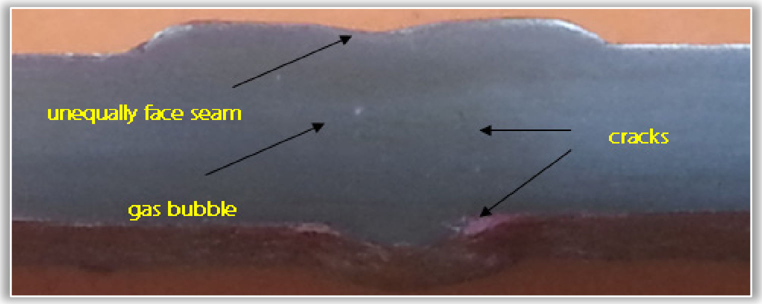
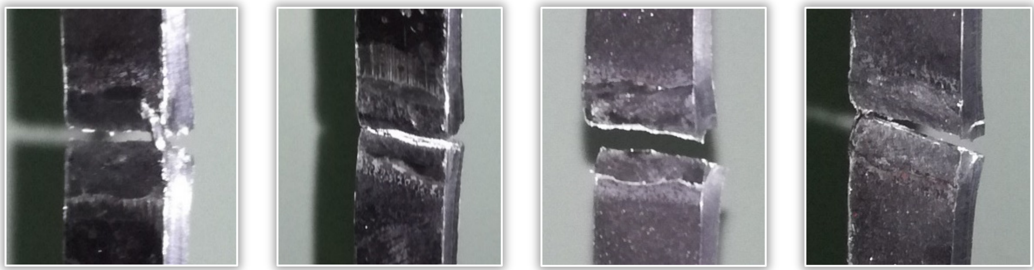


Figure 2. Macro-sectional sample of the welded wire full

Tensile testing

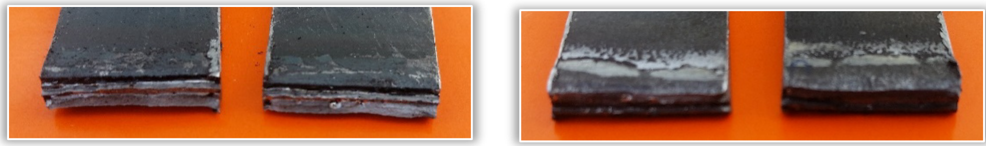
After preparation of the two test tubes cut perpendicular to the weld seam, tensioning of screening was performed on a universal testing machine BETA 200, Messphysik manufacturers. The tubes are sequentially numbered as follows: 1 and 2 in the sample welded Cored, 3 and 4 for a sample welded solid wire. When all the tubes at four cracking is occurred at the welded joint, in Figure 4.

Figure 3. Test tubes prepared for tensile testing

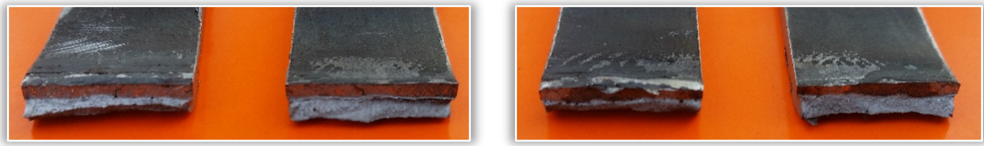


EP1 EP2 EP3 EP4

Figure 4. Fracture test tube



EP1 EP2



EP3 EP4

Figure 5. The front face of the fracture test tube

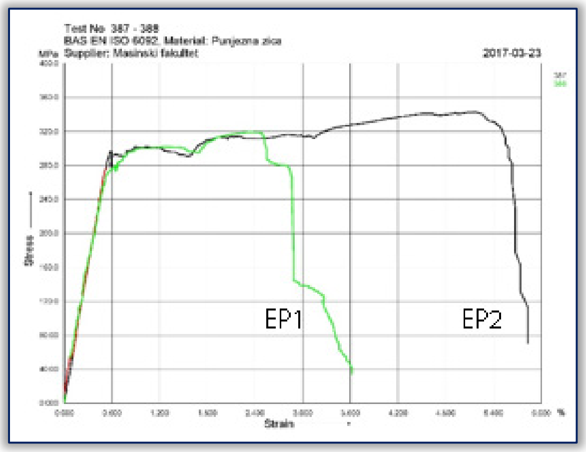


Figure 6. Stress - strain diagram of EP1 and EP2

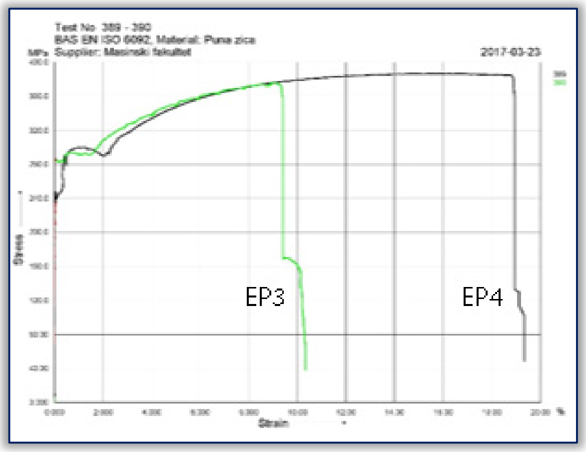


Figure 7. Stress - strain diagram of EP3 and EP4

From the look of fracture surface of test tube can be concluded that:

- none of the test tube was not welded over the cross-section
- on tubes visibly sticking to half the thickness of the sheet
- to all the tubes was pronounced contraction
- break a predominantly brittle structure
- traces of inclusions and gas bubble

By analyzing the stress – strain diagram it can be seen that the application of the cored wire the tensile strength was 340 MPa maximum, and the solid wires 385 MPa.

In both cases, the weld strength is less than the strength of pure deposits achieved using cored and solid wires, ie. 560 N/mm^2 (MPa). Welded joints technological tests, do not meet.

5. CONCLUSIONS

Welding the PG position requires higher welding speed but in the same time amount of heat input is lower and welds have lower toughness and higher brittleness.

Welded technological tests performed with the parameters mentioned in this paper, because of insufficient strength and penetrations do not meet the required quality of the compound.

For gaining quality welded joints on new technological rehearsals, it is necessary to perform correction of welding parameters.

Note

This paper is based on the paper presented at 13th International Conference on Accomplishments in Mechanical and Industrial Engineering – DEMI 2017, organized by University of Banja Luka, Faculty of Mechanical Engineering, in Banja Luka, BOSNIA & HERZEGOVINA, 26 - 27 May 2017.

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