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PROCEDURE USING GMAW-STT APPLIED AT MAIN PIPELINES WELDING

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Abstract: *The Lincoln Electric Company is the first and only welding company to hold a patent on revolutionary new welding process called Surface Tension Transfer. High productivity welding processes are continuously improved to ensure quality connections that bring required safety factor at our new standards. Welding process MIG / MAG is by far the most productive, is constantly improved.This ensures good penetration and low heat input control. It is ideal for welding joints with open root, on gaps or on thin material with no burnthrough. The paper makes a comparison between the weld root by manual arc welding process and welding GAMW - STT root layer where steel L 245 NB - Grade B, X 42 and X 52 in that run pipelines.*

Keywords: *GMAW – STT, welding processes symbolized, steel- pipe.*

1. INTRODUCTION

This paper aims to study the root welding using GMAW process - STT. Make a comparison between mechanical test results of samples that root welding was done by tubular cored metal arc welding with active gas shield and gas-metal-arc welding shielding.

Unlike standard CV GMAW machines, the STT machines has no voltage control knob Procedure STT uses current controls to adjust the heat independent of wire feed speed, so changes in electrode extension do no affect heat. The STT process makes weld that require low heat input much burning through, and distortion is minimized. Spatter and fumes are reduced because the electrode is not overheated-even with larger diameter wires and 100 CO_2 shielding gas. This gas and wire combination lowers consumable costs.

2. EXPERIMENTAL RESEARCH

Experimental tests were performed with equipment manufactured de firma Lincoln Electric Power Wave 445M/STT/Power Feed TM 10 M dual. This is a digitally controlled inverter power source capable of complex, high-speed waveform control. It is designed to be part of a modular, multi- process welding system. This product features Lincoln Electric's STT process for applications in which heat input control, minimal distortion, reduced spatter and low fumes are essential.

In the study we used steel for pipelines for the transport of natural gas:
Parent Material:

- Steel pipelines L 245 NB (group 1.1 acc. EN 15608) - Grade B;
- Steel pipelines L 290 NB (group 1.2 acc. EN 15608) - X 42;
- Steel pipelines L 360 GA (group 1.2 acc. CEN ISO / TR 15608) - X 52.

Were chosen to study 3 welding processes symbolized according to EN ISO 4063 which

establishes reference numbers welding processes:
111 - manual arc welding with coated electrode;
135 - Arc welding electrode active gas burnt in the environment; MAG welding;
136 - MAG welding with tubular wire [1].
Welding positions are according to ISO 6947:
PF - vertically upward;
PG - vertically downward;

Certification tests were performed accordance to EN ISO 15614-1: 2005/A1/ 2008.

In all samples was processed welding point V, opening 60^0 (Fig. 1).

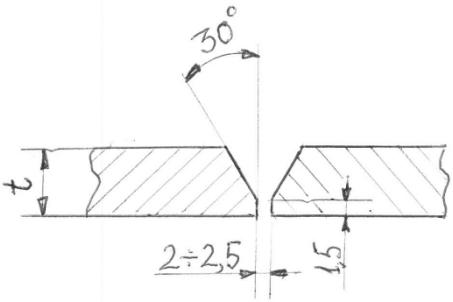

Figure 1. Welding joint geometry

Legend for Hardness Test charts:

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2.1 Sample I.

Welding process: 136 + 111.

Joint type – butt weld (Foto 1).

Parent Material Specification EN 10208/2: L 245 NB Grad B (group 1.1. acc. EN 156080), outside diameter Φ= 88,9 mm, material thickness, t=6 mm (API – 5L) [2].

All weld metal:

Root : procedure 136 (Tubular cored metal arc welding with active gas shield), welding cored wire type HYUNDAI Supercored 70 NS (E70C-6M acc.AWS A5.18).

Filler : procedure 111 (Metal arc welding), covered electrode type FRO SANBAZ (E 42 5 B 42 H5 acc.EN 2560-A).

Shielding Gas: CORGON (M21 acc. EN 439).

Type of Welding Current: DC^+.

Welding positions: PF.

Interpass Temperature: 200^0 C

Gas Flow Rate-Shielding:15 – 20 l/min [3].

2.1.1 Details of weld test.

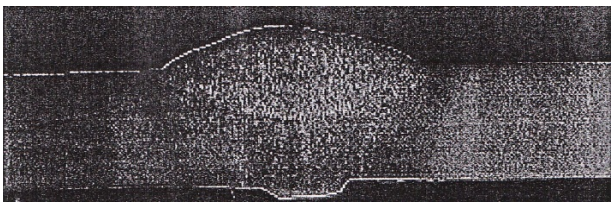

Foto 1. Sample 1. Material L 245 NB Grad B.

2.1.2 Hardness test HV 10

		Root	Filler	Top L.
1	BM	148		147
2	BM	146		145
3	BM	149		144
4	HAZ	197		196
5	HAZ	193		191
6	HAZ	194		192
7	WM	209		203
8	WM	207		206
9	WM	210		204
10	HAZ	196		193
11	HAZ	198		192
12	HAZ	197		194
13	BM	149		148
14	BM	150		146
15	BM	148		143

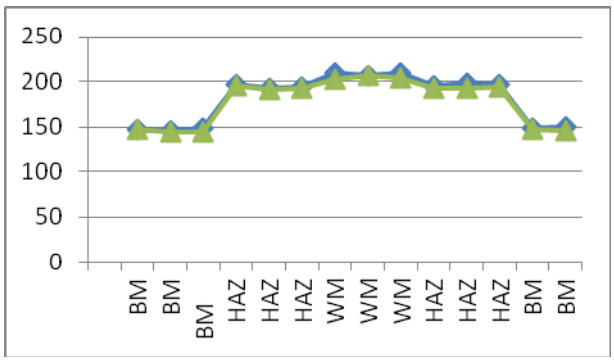

Figure 2. Hardness variation for L 245 NB

2.2 Sample II

Welding process : 135(PG)+111(PF)

Joint type – butt weld (Foto 2).

Parent metal: L360 GA (group 1.2. acc. CEN ISO/TR 15608) - X 52, outside diameter Φ=508 mm, material thickness, t=8,8 mm (API – 5L).

All weld metal:

Root : procedure 135; (Gas-shielding metal-arc welding), welding wire type SUPRAMIG(ER70S-6 acc. AWS A5. 18-93.

Filler: procedure 111; (Metal arc welding), covered electrode type SANBAZ (E 7018-1H4R acc. AWS A5.1).

Shielding Gas: CO_2 =99.99% (C1 acc. To EN 439). Type of Welding Current: CC+.

Welding positions: 135(PG)+111(PF).

Interpass Temperature: max. 200^0 C.

2.2.1 Details of weld test

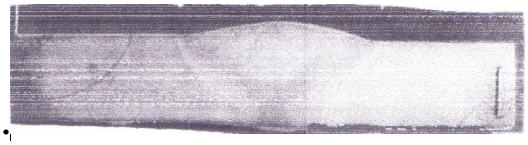

Foto 2. Sectiune cusatura X 52

2.2.2 Hardness test HV 10

		Root	Filler	Top L.
1	BM	180		
2	BM	182		
3	BM	185		
4	HAZ	209		
5	HAZ	207		
6	HAZ	205		
7	WM	215		
8	WM	213		
9	WM	216		
10	HAZ	202		
11	HAZ	206		
12	HAZ	208		
13	BM	184		
14	BM	181		
15	BM	180		

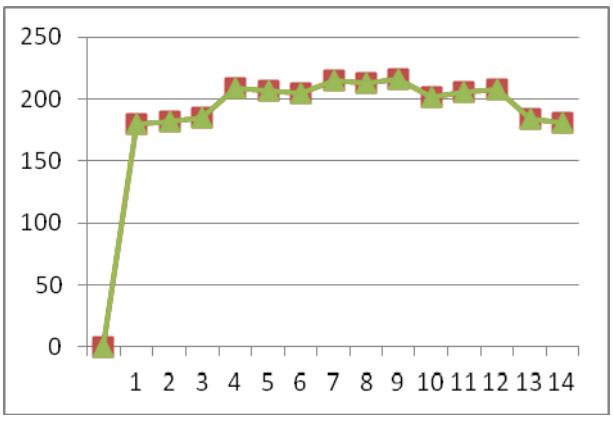

Figure 3. Hardness variation for X 52.

2. 3 Sample III

Welding process: 111

Joint type – butt weld (Foto 3).

Parent Material Specification EN 10208/2: L 290 NB (group 1.2. acc.EN 15608) - X 42, outside diameter Φ=323,9 mm, material thickness, t=12,5 mm (API – 5L).

All weld metal:

Root: procedure 111 (Metal arc welding), covered electrode type FOX EV PIPE (E 42 4 B 12 H5 acc. EN 2560-A).

Filler: procedure 111 (Metal arc welding), covered electrode type FRO SANBAZ (E 42 5 B 42 H5 acc. EN 2560-A).

Welding position: PF;

Type of Welding Current: DC^+.

Interpass Temperature: 200^0 C

2.3.1 Details weld test

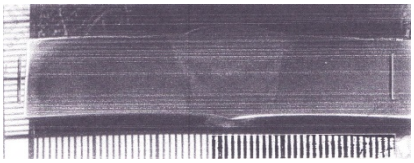

Foto 3. Sample 3. L 290 NB - X 42

2.3.2 Hardness test HV 10

		Root	Filler	Top L.
1	BM	144	140	142
2	BM	142	141	144
3	BM	140	143	141
4	HAZ	163	164	166
5	HAZ	158	164	165
6	HAZ	164	162	165
7	WM	175	186	180
8	WM	177	189	182
9	WM	173	185	185
10	HAZ	168	164	165
11	HAZ	173	166	170
12	HAZ	171	165	169
13	BM	139	145	141
14	BM	140	140	145
15	BM	142	144	142

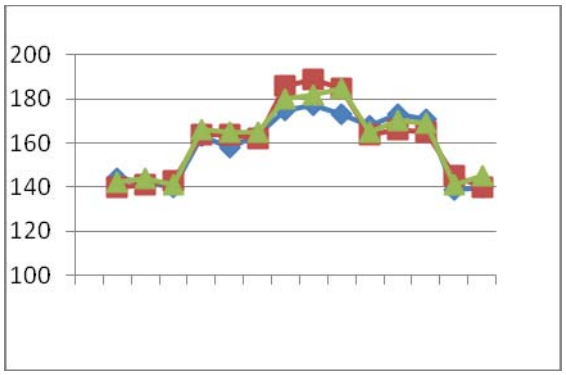

Figure 4. Hardness variation for X 42.

3. CONCLUSIONS & ACKNOWLEDGMENT

Of experiments and the interpretation of results of root layer improves hardness values. microhardness we conclude that the process of shielded gas welding GMAW – STT root layer improves hardness values (Fig.2,3 and 4).

Since the quality depends on the quality welding seam root this study justified the application welding process referred to mentioned welding root welding layer [4],[5].

Hardness test HV 10 shows the hardness values HV GMAW welding process - STT can be applied widely in automated welding pipelines. Following this research the following conclusions are drawn:

- modified short arc with the amperage and voltage changed based upon the results of the arc;
- low heat input;
- controlled heat input;
- all position welding;
- handles poor fit up;
- minimal spatter;
- can use a larger wire size;
- minimal smoke;

The STT also makes welds that require low heat input much easier – without overheating or burning through, weld distortion is therefore minimised. Good penetration at low heat input also makes it ideal for open roots, gaps or thin material. Spatter and fumes are also reduced as the electrodes are not overheated, even with larger wire diameters and 100% CO_2 gas – which in turn reduces consumable costs, the current is controlled to achieve optimum metal transfer.

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