Development of a GMAW Process for Leak Reduction in Sheet Steel - Plate

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Objectives

Certified GMAW welding process between plate and sheet metal using advanced high-strength steel (AHSS) and a high wire feed speed. This process presents an opportunity for improvement due to defects detected in the assembly area. These defects are caused by spatter generated by an unstable welding arc, which can lead to lack of fusion. Because the shot blasting cleaning process removes evidence of these defects, they may only be detected during the leak test.

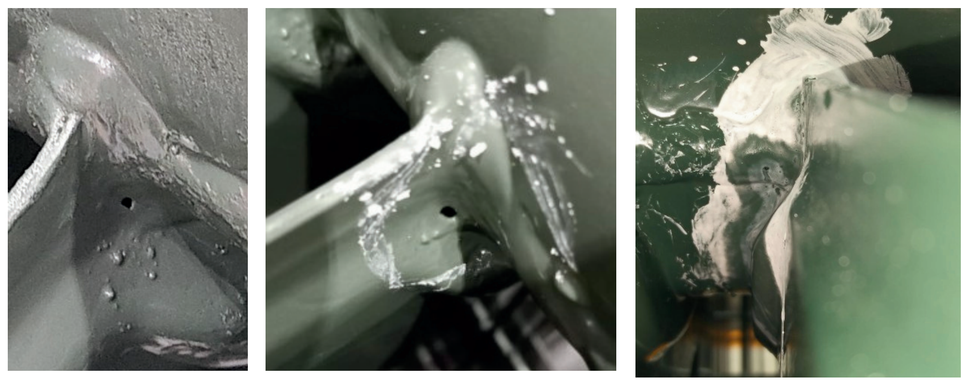


Figure No. 1 GMAW Welding Tube / Sheet Steel

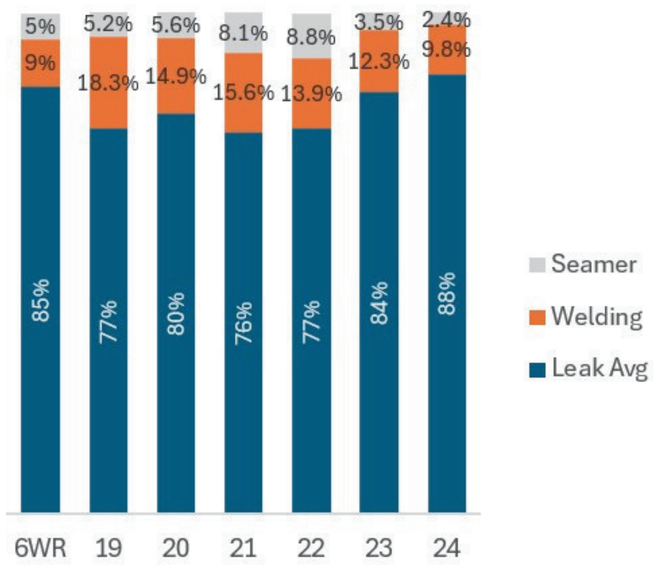
Introduction

The GMAW spray transfer welding process has experienced leak issues because it was implemented without an approved PQR. The welded joint has a 2 inch thickness mismatch, and the selected welding parameters produce an unstable welding arc, generating excessive spatter in the adjacent areas. This increases rework due to the need for spatter removal. Additionally, the process results in insufficient root penetration and an excessively large weld bead caused by a high wire feed rate, which increases the heat input and the risk of undercut formation at the weld toes.

Figure No. 1 GMAW Welding Tube / Steel Sheet Sample Production

Figure No. 4
Leak Perpormance

Leak Performance in 6 week roll focus in welding decrese after welding process realese.



Conclusion

After the mechanical testing of the T-joint and the macroetch examination, it was determined that the weld achieved 1/4" leg, in sheet steel 50% and 25% penetration into the tube base material. Based on these results, the welding procedure with the high wire feed rate can be approved, as it improves leak performance and reduces rework caused by leaks detected at the Leak Test station, in accordance with the verification requirements of AWS D1.3.

Figure No. 6 Welding Parameters Performance

Following the successful qualification procedure, a Welding Procedure Specification (WPS) can be released for joints between sheet steel and steel plate using a high wire feed rate. The welding parameters shall be controlled within the maximum qualified limits to ensure consistent weld quality and compliance with the approved procedure.

Methodology

According with the code AWS D1.3 need to aprobe WPS & PQR with macrotech and break test with no cracked

- Fillet Weld (1/4" Leg)
- Tube 4“ OD, Wall ¼”, ASTM A500, Grade B
- Sheet Steel, ASTM1008 DS Type B, Gauge 18
- GMAW Spray Transfer

The test sample was fabricated to produce a T-Joint with a fillet weld in 2F position. Welding was performed using the GMAW process with ER70S-6 filler wire (0.035 in.) and a shielding gas mixture of 90% Argon and 10% CO_2, as specified in the AWS D1.3 joint sketch.

Figure No. 2
AWS D1.3 Welding Code Sheet Steel

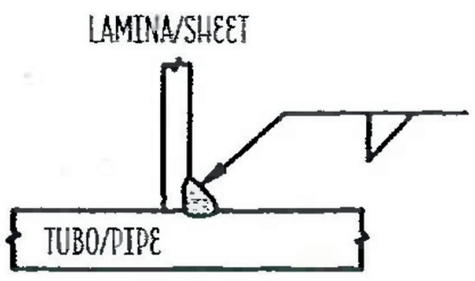


Figure No. 3
T Sketch Joint

Results

The welded sample is cut in the transverse direction and then etched with acid to reveal the boundary between the weld metal and the base metal. This allows the weld penetration to be evaluated and determines whether adequate fusion has been achieved throughout the joint.

According macroetch and the profile weld are adequate to use of this application, after this change we can view a better performance in leak test in the last 6 weeks, using high feed rate according Fig No. 4

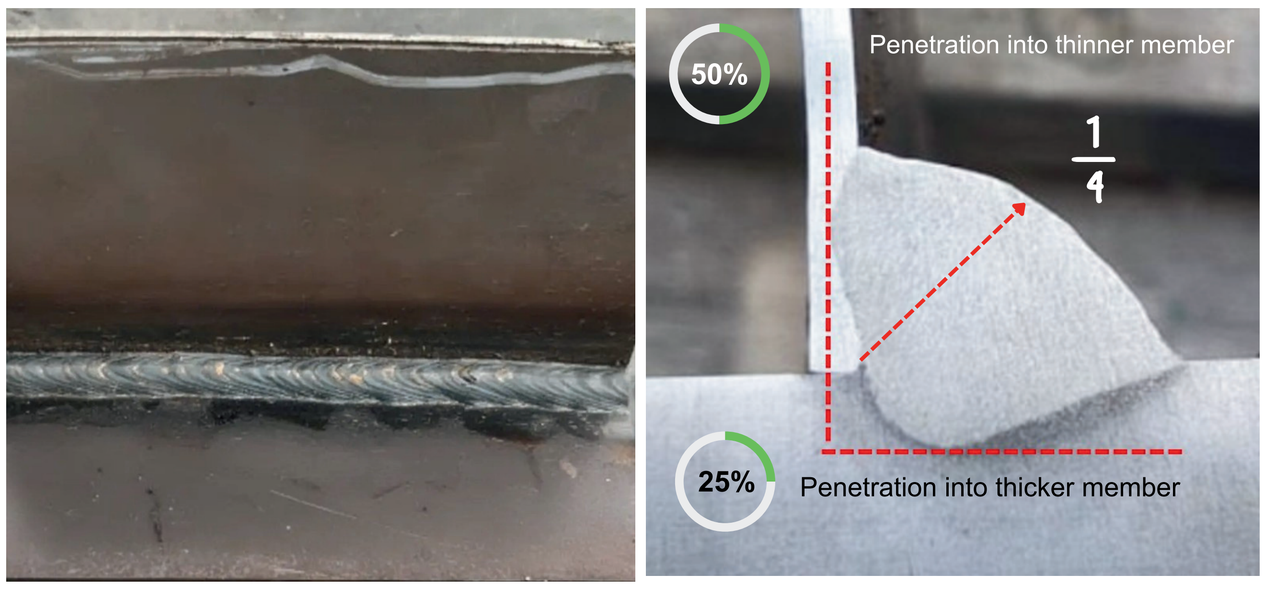


Figure No. 5 Test Sample T Joint / Macro Attack

References

AWS D1.3 Structural Welding Code Sheet Steel
https://www.lincolnelectric.com/es-mx/products/superarcl56_gmaw