

SPB3. Comparison Of GTAW & PAW On Titanium 6Al-4V & Inconel 718

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Introduction

GE currently uses GTAW in repair applications but could switch to PAW if advantages exist. Traditionally advantages of PAW over GTAW have been arc stability, smaller HAZ, less thermal distortion, and better arc starting. The objectives of this study were to:

- establish parameters to produce welds on Titanium-6Al-4V and Inconel 718 that have nominal dimensions based on GE group acceptability criteria for GTAW and PAW.
- Compare changes in weld parameters to changes in weld dimensions for GTAW and PAW and draw a conclusion as to which process is more tolerant to variable change.

Technical Approach & Results

Experiments were made using each process to determine variables that achieved nominal weld dimensions. Next, 8 additional welds were produced by varying current, voltage, travel speed and wire feed speed 10% above and below the ideal parameters. The welds were cross-sectioned and etched to reveal penetration and weld bead width and a PAX-IT imaging system used to photograph samples and measure penetration.

Dimensions were plotted in relation to acceptance criteria and analysis was done to determine which process was more resistant to variable changes. Each weld was plotted as a point on a chart of penetration versus weld width. Tolerance boxes were calculated to give a physical representation of the tolerance to change for the GTA and PAW processes. To form these boxes the average penetration and weld bead width were calculated and plotted. A standard deviation from the average was calculated and extended in each direction to form the boxes. This technique was used to show the tolerance to variable changes. The same amount of variable change in the two processes resulted in smaller GTAW tolerance boxes and hence, the GTAW was more tolerant than PAW

Conclusions

1. The nominal parameters were found for each process and material per GEAE specifications.
2. Changing variables 10% in the PAW and GTAW process resulted in slightly smaller changes in weld dimension when using GTAW.
3. There is no reason for GEAE to change their process from GTAW to PAW.

Future work includes:

1. Perform a larger set of welds varying parameters up to 20% to see if the same results are obtained.
2. Vary more than one parameter at a time using Design of Experiments to see if doing so will add additional support to our conclusion.