



A Viability Study for the Adoption of 90/10 Shielding Gas at the Honda East Liberty Plant

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Background

- The Honda East Liberty Plant relies heavily on robotic GMAW process for joints that are not possible with RSW
- Currently, 75/25 argon-CO₂ shielding gas is used throughout the facility. However, while C25 gas is cost effective, it is not without its disadvantages.
- Amongst other weld-quality issues with the Honda ELP's robotic GMAW operation, excessive weld spatter ranks highest in severity.
- Excessive weld spatter in a fast-paced production environment is costly, both in labor and time.
- The group sponsor is in favor of recommending to management a switch to 90/10 argon-CO₂ shielding gas. In order to do this though, quantifiable data needs to be presented, showing that there is in fact a substantial improvement to be had with the more expensive shielding gas.

Motivation

- Time and labor savings on account of less post-weld cleanup.
- Potential for faster, higher-quality welding with parameter refinement.

Objectives & Approach

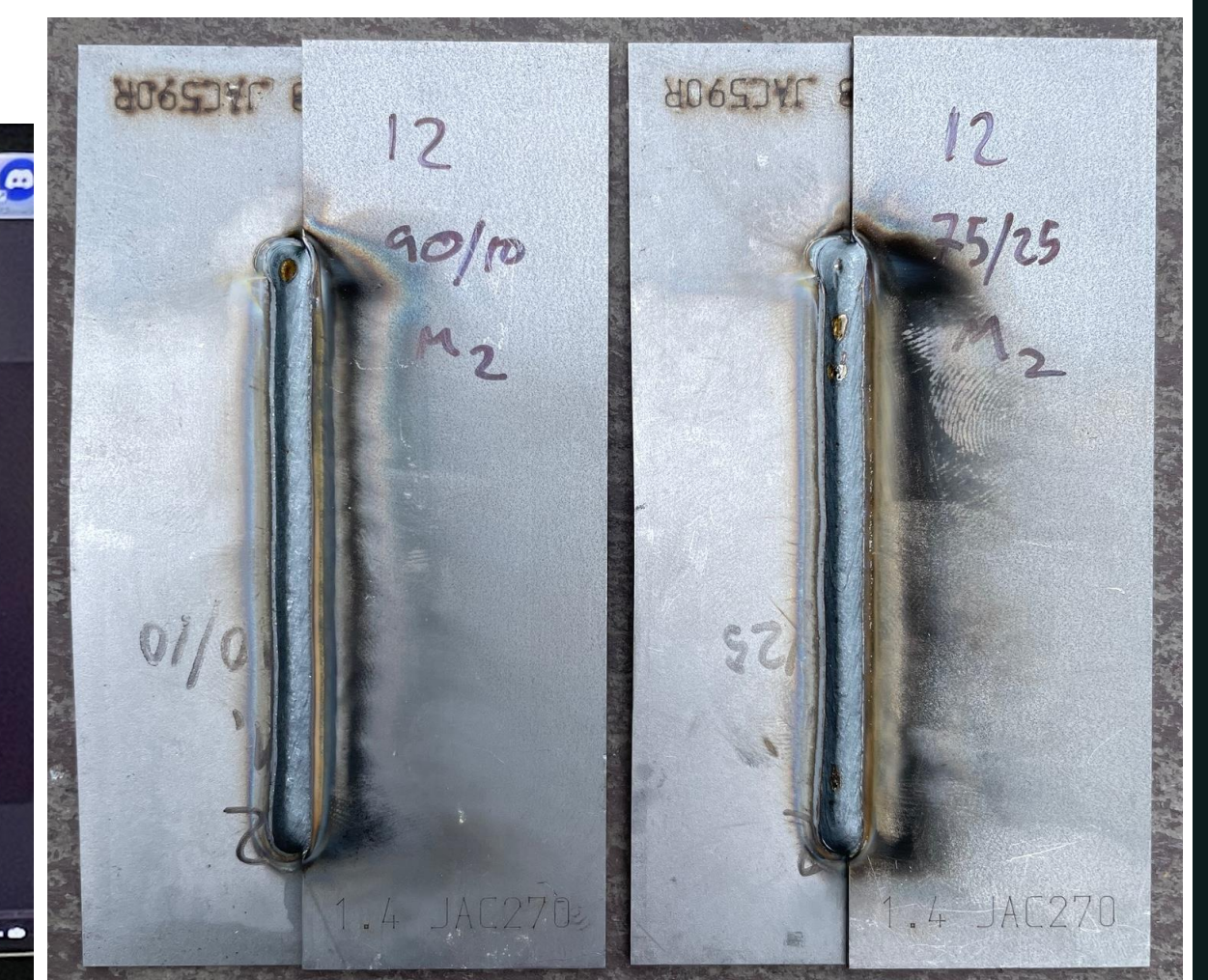
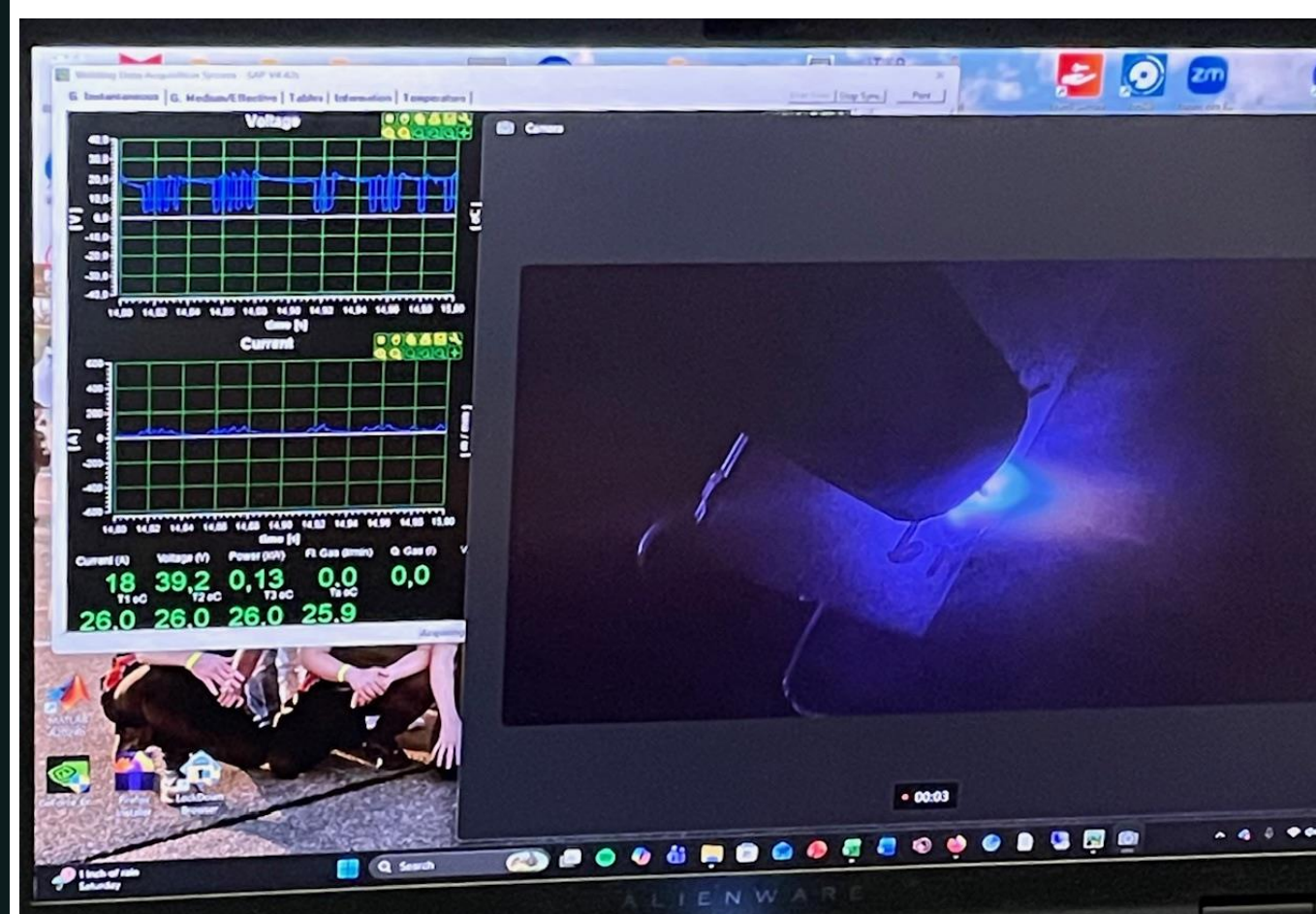
- ☐ Develop baseline robotic GMAW parameters using 75/25 argon-CO₂ shielding gas, in order to ensure reliable weld penetration and quality.
- ☐ Create an equivalent set of parameters with 90/10 shielding gas to evaluate its potential for production use.
- ☐ Identify optimal combinations of wire feed speed, voltage, and travel speed that maximize deposition and reduce defects.
- ☐ Provide detailed data and actionable recommendations to help Honda assess the potential cost, quality, and efficiency benefits of switching gas compositions.

Conclusions

Through the usage of sophisticated machine learning and image analysis tools, this experiment was able to quantify weld spatter production and attribute it to its respective shielding gas. The analysis of weld footage provided tangible evidence that 90/10 argon-CO₂ shielding gas had significantly less susceptibility to weld spatter than 75/25. Average change in mean percentage area of spatter per frame by switching to 90/10 shielding gas was a 37.8% reduction. Average change in mean total area per frame by using 90/10 over 75/25 was a 37.8% reduction as well. Additionally, 90/10 shielding gas provided a 12% particle count reduction over 75/25. It is conclusive; 90/10 argon-CO₂ shielding gas is quantifiably superior to 75/25 for the purpose of these joints in a robotic GMAW production environment. With the results of this experiment, the team sponsor can propose a shielding gas change to management of the Honda ELP with confidence.

Results & Discussion

- Welds of requested material/position combinations were performed in both 75/25 and 90/10 shielding gas for comparative analysis.
- Work performed relied on the same power supply (Lincoln Electric Power Wave R350) as the Honda ELP, utilizing Power Mode.
- In order to quantify weld spatter, all welds were recorded in video for the sake of particle analysis through a combination of MIPAR and Image J image analysis software.



Metric	Value
Primary metric	Mean %Area per frame
Schedules compared	18
c10 wins on mean %Area	16
c25 wins on mean %Area	2
c10 wins on mean total area	16
c25 wins on mean total area	2
c10 wins on mean count	18
c25 wins on mean count	0
Average relative change in mean %Area (c10 vs c25)	46.08306887
Average relative change in mean total area (c10 vs c25)	46.0766563
Average relative change in mean count (c10 vs c25)	50.0519393
Weighted overall mean %Area, c10	0.031429736
Weighted overall mean %Area, c25	0.050046861
Weighted overall mean count, c10	3.856886841
Weighted overall mean count, c25	6.511763151
Weighted overall mean total area, c10	651.7391193
Weighted overall mean total area, c25	1037.887391

Spatter comparison: c10 vs c25 by schedule

Main metric used for "better"	Lower mean %Area per frame
Schedules compared	18
Schedules where c10 had lower mean %Area	17
Schedules where c25 had lower mean %Area	1
Average c10 vs c25 change in mean %Area	-37.8%
Median c10 vs c25 change in mean %Area	-39.0%
Average c10 vs c25 change in mean total area/frame	-37.8%
Average c10 vs c25 change in mean count/frame	-12.0%

Notes

Sch10c10 summary file had appended duplicate/mixed content; analysis kept only matching Sch10 90-10 slices and removed duplicate slice rows. Frame counts differ between some paired runs, so comparisons are based mainly on per-frame means instead of raw totals.

Interpretation

Negative c10-vs-c25 % change means c10 produced less spatter on that metric.