

ABSTRAK

ANALISIS KEKUATAN SAMBUNGAN LAS MIG GERAK HORIZONTAL BERBASIS ESP32 TERHADAP VARIASI ARUS DAN JENIS MATERIAL

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(2026: xii + 81 Halaman, 42 Gambar, 16 Tabel, 8 Lampiran)

Pengelasan *Metal Inert Gas* (MIG) banyak digunakan dalam industri manufaktur karena produktivitas tinggi dan kemampuannya menghasilkan sambungan yang berkualitas. Kualitas sambungan las dipengaruhi oleh besar arus pengelasan dan konsistensi kecepatan gerak *torch*. Penelitian ini bertujuan menganalisis pengaruh variasi arus pengelasan dan jenis material terhadap kekuatan tarik dan regangan sambungan las MIG gerak horizontal berbasis ESP32, serta menentukan kombinasi parameter yang paling optimal. Metode eksperimen digunakan dengan tiga variasi arus (70 A, 80 A, dan 90 A) pada material ASTM A36, ST37, dan SS400 berketebalan 3 mm. Pengelasan dilakukan menggunakan alat bantu gerak horizontal semiotomatis berbasis ESP32 dengan kecepatan konstan 6 mm/s untuk meminimalkan *human error*. Spesimen uji tarik dibuat berdasarkan standar ASTM E8 dan data dianalisis menggunakan statistik deskriptif serta ANOVA dua arah tanpa replikasi pada taraf signifikansi $\alpha = 0,05$. Hasil penelitian menunjukkan bahwa variasi arus dan jenis material berpengaruh signifikan terhadap tegangan tarik ($F = 39,938$ dan $F = 46,410$; Sig. 0,002) maupun regangan ($F = 107,091$ dan $F = 85,273$; Sig. $\leq 0,001$). Peningkatan arus dari 70 A ke 90 A meningkatkan tegangan tarik rata-rata dari 443,553 MPa menjadi 484,287 MPa. Tegangan tarik tertinggi diperoleh pada material ASTM A36 sebesar 503,762 MPa pada arus 90 A. Kombinasi arus 90 A dan material ASTM A36 menghasilkan sifat mekanik sambungan las terbaik pada kondisi penelitian ini.

Kata Kunci: Pengelasan MIG, ESP32, ASTM A36, ST37, SS400

ABSTRACT

ANALYSIS OF THE STRENGTH OF MIG WELDED JOINTS WITH ESP32 BASED HORIZONTAL MOTION ON CURRENT VARIATIONS AND MATERIAL TYPES.

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Metal Inert Gas (MIG) welding is widely used in the manufacturing industry due to its high productivity and ability to produce high-quality joints. Joint quality is influenced by welding current and the consistency of torch travel speed. This study aims to analyze the effect of welding current variations and material types on the tensile strength and elongation of MIG welded joints using an ESP32-based horizontal motion system, as well as to determine the most optimal parameter combination. An experimental method was employed using three current levels (70 A, 80 A, and 90 A) applied to ASTM A36, ST37, and SS400 steel plates with a thickness of 3 mm. Welding was performed using a semi-automatic ESP32-based horizontal motion device at a constant speed of 6 mm/s to minimize human error. Tensile test specimens were prepared according to ASTM E8 standards, and the data were analyzed using descriptive statistics and two-way ANOVA without replication at a significance level of $\alpha = 0.05$. The results show that both welding current and material type have a significant effect on tensile strength ($F = 39.938$ and $F = 46.410$; Sig. 0.002) and elongation ($F = 107.091$ and $F = 85.273$; Sig. ≤ 0.001). Increasing the current from 70 A to 90 A raised the average tensile strength from 443.553 MPa to 484.287 MPa. The highest tensile strength of 503.762 MPa was achieved by ASTM A36 at 90 A. The combination of 90 A welding current and ASTM A36 material produced the best mechanical properties under the conditions of this study.

Keywords : MIG welding, ESP32,, Tensile Strength, ASTM A36, ST37, SS400