

ABSTRAK

Penelitian ini bertujuan untuk meningkatkan kualitas sambungan las pada konstruksi kapal dalam industri maritim. Tahap *shipbuilding*, yang mencakup desain hingga *outfitting*, sangat bergantung pada proses pengelasan, terutama saat *sub-assembly*, *assembly*, dan *erection*. Salah satu metode pengelasan yang digunakan adalah *Flux Cored Arc Welding* (FCAW) dengan elektroda E71T-1 dan gas pelindung CO₂ 100%. Penelitian ini menggunakan variasi parameter berupa ketebalan pelat (8 mm, 10 mm, 12 mm), voltase (24 V, 25 V, 26 V), dan *wire feed rate* (4 m/menit, 4,5 m/menit, 5 m/menit). Tujuan utama adalah memperoleh hasil lasan dengan distorsi sudut minimal, ketangguhan impak *Charpy* maksimal, serta bentuk manik las (*weld bead*) yang sesuai. Optimasi dilakukan secara simultan menggunakan metode *Response Surface Methodology* (RSM) dengan desain eksperimen *Box-Behnken Design* (BBD). Proses ini dianalisis menggunakan *Desirability Function*, di mana nilai D-optimal sebesar 0,645568 menunjukkan kondisi paling ideal. Hasil optimasi menunjukkan nilai distorsi sudut minimum sebesar 0,00036°, ketangguhan impak maksimum 2,008 J/mm², tinggi manik las 2,17 mm, dan lebar manik las 17,738 mm. Kombinasi parameter optimal diperoleh pada ketebalan 8 mm, voltase 24 V, dan *wire feed rate* 4,5 m/menit. Hasil ini menunjukkan keseimbangan antara kekuatan, ketahanan terhadap benturan, dan presisi geometri sambungan.

Kata kunci : *Flux Cored Arc Welding* (FCAW), Ketangguhan impak *Charpy*, Distorsi sudut (*angular distortion*), *weld bead geometry*, *Response Surface Methodology* (RSM), Konstruksi kapal.

ABSTRACT

This study aims to improve the quality of weld joints in ship construction within the maritime industry. The shipbuilding process, which includes design to outfitting stages, heavily relies on welding, especially during the sub-assembly, assembly, and erection phases. One of the welding methods applied is Flux Cored Arc Welding (FCAW) using E71T-1 cored wire electrodes and 100% CO₂ shielding gas. The study utilizes parameter variations including plate thicknesses (8 mm, 10 mm, 12 mm), voltage levels (24 V, 25 V, 26 V), and wire feed rates (4 m/min, 4.5 m/min, 5 m/min). The main objective is to achieve welds with minimal angular distortion, maximum Charpy impact toughness, and appropriate weld bead geometry. Simultaneous optimization was conducted using the Response Surface Methodology (RSM) with a Box-Behnken Design (BBD) experimental design. The analysis was performed using the Desirability Function, in which a D-optimal value of 0,645568 indicates the most desirable welding condition. The optimization results show a minimum angular distortion of 0,00036°, a maximum Charpy impact toughness of 2.008 J/mm², a bead height of 2.17 mm, and a bead width of 17.738 mm. The optimal parameter combination was found at a plate thickness of 8 mm, voltage of 24 V, and wire feed rate of 4.5 m/min. These results demonstrate a balanced outcome in terms of strength, impact resistance, and precise weld geometry.

Keywords: Flux Cored Arc Welding (FCAW), Charpy Impact Toughness, Angular Distortion, Weld Bead Geometry, Response Surface Methodology (RSM), Ship Construction.