Optimization of MAG Welding Process Parameters Using Taguchi Design Method on Dead Mild Steel

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Abstract : Welding is a basic manufacturing process for making components or assemblies. Recent welding economics research has focused on developing the reliable machinery database to ensure optimum production. Research on welding of materials like steel is still critical and ongoing. Welding input parameters play a very significant role in determining the quality of a weld joint. The metal active gas (MAG) welding parameters are the most important factors affecting the quality, productivity and cost of welding in many industrial operations. The aim of this study is to investigate the optimization process parameters for metal active gas welding for 60x60x5mm dead mild steel plate work-piece using Taguchi method to formulate the statistical experimental design using semi-automatic welding machine. An experimental study was conducted at Bishoftu Automotive Industry, Bishoftu, Ethiopia. This study presents the influence of four welding parameters (control factors) like welding voltage (volt), welding current (ampere), wire speed (m/min.), and gas (CO_2) flow rate (lit./min.) with three different levels for variability in the welding hardness. The objective functions have been chosen in relation to parameters of MAG welding i.e., welding hardness in final products. Nine experimental runs based on an L9 orthogonal array Taguchi method were performed. An orthogonal array, signal-to-noise (S/N) ratio and analysis of variance (ANOVA) are employed to investigate the welding characteristics of dead mild steel plate and used in order to obtain optimum levels for every input parameter at 95% confidence level. The optimal parameters setting was found is welding voltage at 22 volts, welding current at 125 ampere, wire speed at 2.15 m/min and gas flow rate at 19 l/min by using the Taguchi experimental design method within the constraints of the production process. Finally, six conformations welding have been carried out to compare the existing values; the predicated values with the experimental values confirm its effectiveness in the analysis of welding hardness (quality) in final products. It is found that welding current has a major influence on the quality of welded joints. Experimental result for optimum setting gave a better hardness of welding condition than initial setting. This study is valuable for different material and thickness variation of welding plate for Ethiopian industries.

Keywords : Weld quality, metal active gas welding, dead mild steel plate, orthogonal array, analysis of variance, Taguchi method

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