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THE EFFECT OF CURRENT VARIATION ON TENSILE STRENGTH IN SMAW WELDING USING SS400 STEEL

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Abstrak.

Pengelasan merupakan salah satu proses penting dalam industri manufaktur. Salah satu metode pengelasan yang saat ini digunakan adalah pengelasan busur logam (SMAW) shield. Pada pengelasan smaw, arus listrik yang digunakan memiliki peranan yang krusial dalam menentukan karakteristik pengelasan, termasuk kuat tarik pada sambungan las. Tujuan dari penelitian ini adalah untuk mengetahui pengaruh variasi kuat arus terhadap kuat tarik dengan menggunakan baja SS400. Metode yang digunakan dalam penelitian ini adalah metode eksperimen. Penelitian ini dilakukan dengan membuat spesimen dengan jahitan berbentuk V yang kemudian dilakukan pengelasan dengan menggunakan arus ampere yang divariasikan sebesar 75 A, 85 A dan 95 A. Material yang digunakan adalah baja SS400 yang memiliki ketebalan 6 mm. Maka dari penelitian ini diperoleh hasil yaitu nilai akurasi tarik tertinggi yaitu pada akurasi alir 95 pada sampel ker 2 sehingga menghasilkan nilai akurasi tarik total sebesar 1180,60 Kgf. Dan nilai akurasi tarik terendah terdapat pada kurva alir ke 75 pada sampel ker 1, sehingga menghasilkan nilai akurasi tarik total sebesar 1093,88 Kgf. Hal ini dikarenakan setiap variasi akurasi arus sangat mempengaruhi Akurasi Tarik.

Kata kunci: Turbin angin lepas pantai, *CFD, HAWT*, dan Parameter kinerja Turbin

Abstract.

Welding is one of the important processes in the manufacturing industry. One of the welding methods that is currently used is metal arc welding (SMAW) shields. In smaw welding, the electric current used has a crucial role in determining the welding characteristics, including the tensile strength of the weld joint. The aim of this research is to determine the effect of variations in current strength on the tensile strength using SS400 steel. The method used in this research is the experimental method. This research was carried out by making specimens with a V-shaped seam which were then welded using varying amperage currents of 75 A, 85 A and 95 A. The material used was SS400 steel which had a thickness of 6 mm. So, from this research, the results obtained are the highest tensile accuracy value, namely at a flow accuracy of 95 on the ker 2 sample, resulting in a total tensile accuracy value of 1180.60 Kgf. And the lowest tensile accuracy value is at 75 flow curves in the ker 1 sample, resulting in a total tensile accuracy value of 1093.88 Kgf. This is due to the fact that each variation in current accuracy greatly influences the Tensile Accuracy.

Keywords: *Electric Current, Tensile Strength, SMAW, SS400 Steel*

INTRODUCTION

Welding is one of the important processes in the manufacturing industry. Especially in machining metal structures that require high precision and reliability. One of the commonly used welding methods is shielded metal arc welding (SMAW) which is also known as the electric arc welding process or welding with coated electrodes. In SMAW welding, the electric current used has a crucial role in determining the characteristics of the weld, including the tensile strength of the weld joint. SS400 steel is a type of structural carbon steel that is often used in the construction and machining industries.

In the SMAW welding process on SS400 steel, the regulation of the electric current is an important factor that affects the quality of the weld joint. One of the parameters that is often set is the current rectifier which affects the tensile strength of the weld joint. The current rectifier used in welding must be set according to the weld strength. The power required for welding depends on the amount of current and voltage used. The use of the right current rectifier affects the tensile strength of the HAZ area [1][2][3]. Although there have been many studies conducted on SMAW welding, the effect of certain current rectifiers, such as 75 and 85 amperes, on the tensile strength of SS400 steel welding still requires further research. Therefore, research on the effect of 75, 85 and 95 amperes current rectifiers on the tensile strength of SMAW welding using SS400 steel is very relevant [4].

The purpose of the research on SS400 steel is to determine the effect of variations in current strength of 75, 85 and 95 Ampere on tensile strength in SMAW welding using SS400 steel. In addition, this research is to determine the selection of current strength in SMAW welding using SS400 Steel which is recommended as the most optimal in industrial applications [8][9].

RESEARCH METHODOLOGY

Tensile testing is one way to measure the strength of a material by giving several forces in opposite directions to determine the strength data of the material. From the results of the SS400 material tensile test, the tensile force, strain, strain and tensile test curve can be known. The test analysis was obtained using the Universal Testing Machine test machine with a capacity of 5 tons [5].

SS400 material has characteristics that are characterized by its physical, mechanical, thermal and corrosive properties. Among other things, the most important mechanical properties include ductility, hardness, curvature and toughness. One of the requirements for further material processing is its mechanical characteristics [6].

Tensile testing reduces the material's resistance to static forces applied slowly. How to reduce the ss400's mechanical properties, among others, can be known, namely the material's toughness and elasticity. The elastic value of the material can be seen from the tensile test curve in Figure 3.4.3. The mechanical properties are found through tensile test results, namely:
The procedure is used to check the material structure accuracy by applying axial force load.

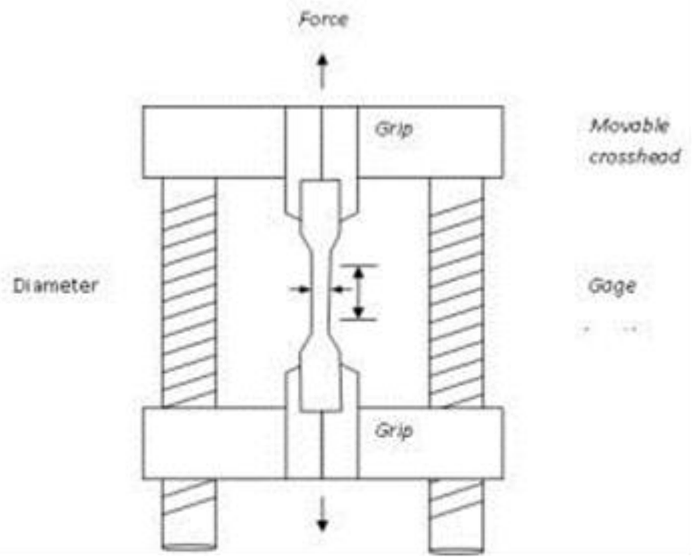

Figure 1. Schematic of tensile testing machine and specimen

Tensile strength is a measure of the mechanical strength of a material. When subjected to axial loading, the tensile strength expands and elongates until it eventually breaks. The tensile strength must meet ASTM E8/E8M standards and specifications. The tensile strength is important because fractures and cracks in the tensile strength area must be avoided. Standardization of the tensile strength ensures that fractures and breaks occur within the measured length [7].

The dimensions of the tensile test are in accordance with the applicable tensile test standards. The dimensions and dimensions of the tensile test are depicted in

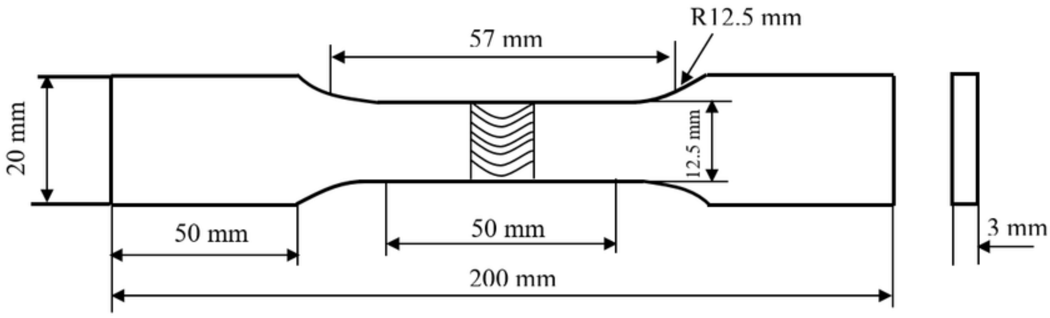

Figure 2. Dimension of tensile test specimen

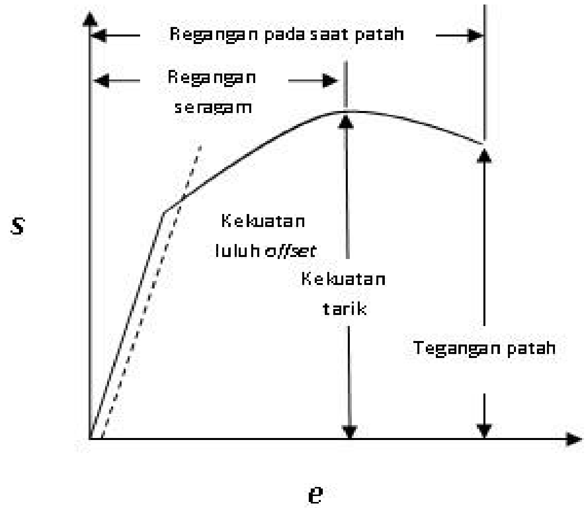

Figure 3. Stress Strain Curve

The commonly used curvatures in tensile test results are the straight curvature and the tensile curvature UTS. The maximum curvature divided by the initial straight curvature of the test produces the tensile curvature [9]. The formula to calculate the tensile strength σ, (N/mm2) as shown in the Equation (1), where, F is maximum moad (N) and A0 is the cross-sectional area (mm^2).

$$\sigma_u = \frac{F}{A_o} \tag{1}$$

RESULTS AND DISCUSSION

In this study, the tensile test data used were 9 specimens. Each variable was replicated three times. This aims to obtain maximum welding results and also to increase productivity. Furthermore, data processing and analysis will be carried out in the form of tables, graphs and discussions. Based on the ASTM E8 / E8M standard, Universal Testing Machine has a capacity of 5 tons [14].

After the tensile test measurement was carried out using the correct procedure, a welding method was obtained to minimize the occurrence of cracks in the welding. The results of the measurement obtained the following data. From the results of the calculation of the cross-sectional area obtained in the tensile test specimen, Width (W) = 13.10 mm, Thickness (T) = 3.2 mm, Cross sectional Area (A_0) is 41.92 mm^2. Table 1 shows the variation of the current which produced a different tensile strength and tensile stress [10][11].

Table 1. Tensile strength with various currents

Currents (A)	Tensile Strength (N/mm^2)		
	1	2	3
75	255,72	256,56	258,87
85	265,73	268,01	270,02
95	266,88	276,00	273,00

From the table above, it can be concluded that, if viewed from the value of the welding data results, the maximum gap accuracy and the variation of the flow accuracy in welding, the higher the flow, the more even the heat distribution in welding can be. This is because the addition of heat during the welding process affects the heat distribution to be even, and not concentrated in the arc welding.

From the results of the research data obtained from the welding process in general, it produces a higher tensile strengths, the following is a discussion of the research [8].

Table 2. Tensile Test Results at Currents of 75, 85 and 95 Ampere

Spercimerns	Materrial	Currents (A)	Dimension (mm)	Area (mm^2)	Length (mm)	Curate Pull (N/mm^2)
1	Materrial SS400	75	t = 3.2 w = 13.10	41.92	60	255.72
2						256.56
3						258.87
4		85				265.73
5						268.01
6						270.02
7		95				266.88
8						276.00
9						273.00

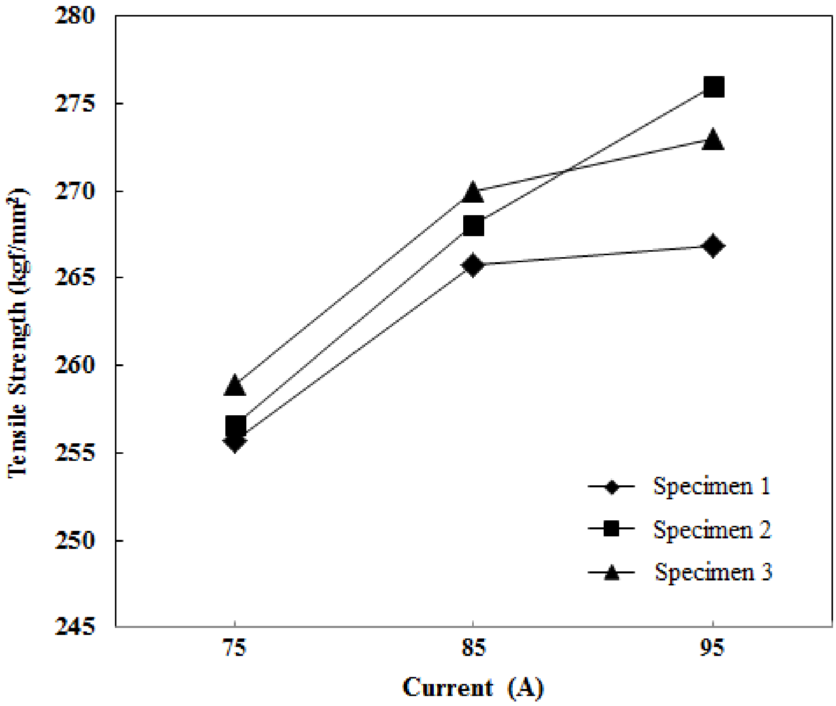

Fig. 4. Tensile test results with currents of 75, 85, and 95 Amperes

The graphic image above shows the effect of variation in the flow rate on the Tensile strength at the V- layer, producing varying tensile strength values. Where, the larger the flow rate value, the larger the Tensile strength. The highest tensile strength value is at a flow rate 95 in sample 2, producing a tensile strength value of 276.00 N/mm^2. The lowest tensile strength value is at a flow rate of 75 in sample 1, producing a tensile strength value of 255.72 N/mm^2. This is because each magnitude of the variation in the flow rate greatly affects the Tensile strength [13].

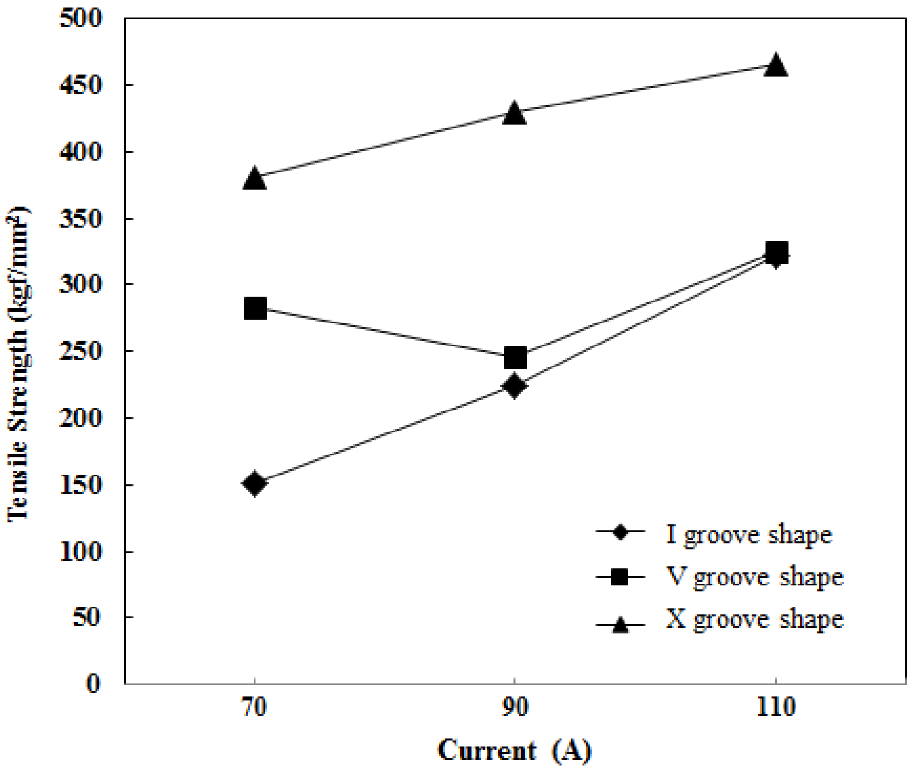

Fig. 5. The effect of groove shape and currents on the tensile strength

From the graphic image above is the effect of the shape of the groove and the variation of the current strength on the tensile strength, resulting in varying tensile strength values. Where the highest tensile strength value is obtained from the X groove shape with a current strength variation of 110 A by producing an average tensile strength value of 466.15 N / mm^2. And the lowest tensile strength value occurs in the I groove shape with a current strength variation of 70 A by producing an average tensile strength value of 150.58 N / mm^2. The highest tensile strength value is in the X groove shape with a current strength variation of 110 A.

This is because each magnitude of the current strength variation greatly affects the tensile strength, secondly followed by the creation of the groove shape. The X groove shape has a groove so that the resulting welding penetration is optimal and the mixing between SS400 steel and electrode material can be evenly distributed. And for the lowest tensile strength value is because the I groove shape does not have a groove and the use of current strength variations is also too low, resulting in less even heat distribution and the penetration results of the welding results that occur are not too deep.

Conclusion

Based on the results and discussion in the main chapter, several conclusions were drawn, including:

1. The tensile strength of the welding results reaches a maximum value at a current of 95 amperes due to the balance between penetration and welding quality. Too low a current can cause the weld results to be less than optimal in terms of tensile strength.
2. From the research results, the recommended welding current for SS400 steel is in the range of 85-95 amperes, depending on the specific conditions.

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