

Welding Training Flux Cored Arc Welding (FCAW) in Improving Welding Skills

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Abstract

The welding connection method offers benefits over other techniques, such as enhanced connection efficiency, suitability for high-temperature applications, and more aesthetically pleasing outcomes. The connections formed through welding are permanent, and the process is quicker. Nonetheless, the quality of welds is significantly impacted by the welder's skill and expertise. Therefore, it is essential to provide welding training to enhance skills, which is why a training program was organized for the community in Laok Jang-Jang Village, located in Arjasa District, Sumenep Regency, East Java Province. This training covers topics including Occupational Health and Safety (K3), basic Flux Cored Arc Welding (FCAW), and practical welding exercises. The results of the training indicated a noteworthy improvement in the trainees' abilities, evidenced by their welds being free of defects. This suggests that the trainees successfully applied the knowledge gained prior to performing the FCAW welding tasks.

Keywords: Training; Flux Cored Arc Welding; Welding Skills

1. Introduction

Welding is a process used to join several metal rods by heating the filler metal until it melts and produces a connection with the parent metal. Welding is the process of joining two or more materials, usually metal, using heat energy until the materials melt and fuse, either with or without pressure or with or without additives. This metal joining technique is widely used in the automotive and construction industries, such as in bridges, piping, and trains, and also to connect panels on aircraft bodies. The community also often uses welding techniques to connect stairs, iron fences, make windows, and more.

Welding Flux Core Arc Welding (FCAW) is a welding process that uses gas and flux. This welding is also known as double shield welding. The flux in the hollow electrode shields the electric arc between the weld pool and the electrode. In other words, FCAW welding is a welding process that uses flux and CO₂ gas as a shield for the weld metal during the welding process.

Better connection efficiency, suitability for high-temperature construction, and neater outcomes are some of the benefits of the welding connection method over other approaches. In addition to being quicker, the welding process creates a lasting bond. However, the skill and competence of the welder have a significant impact on the quality of the welding outcomes. For this reason, welding instruction is crucial to helping the residents of Laok Jang-Jang Village, Arjasa District, Sumenep Regency, East Java Province, develop their skills. As can be seen here, job data indicates the necessity for welding skills, while data on community education indicates the possibility of taking welding courses.

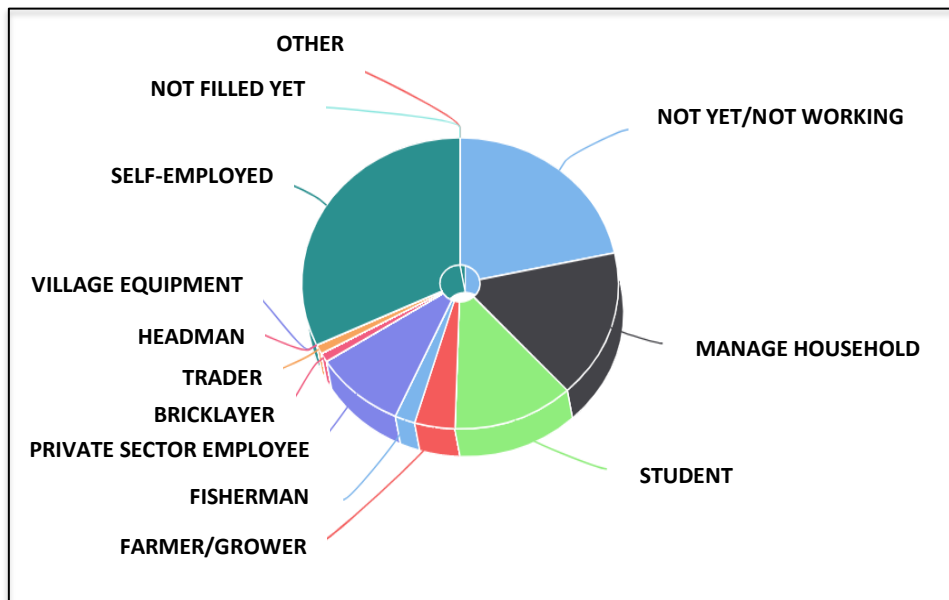


Figure 1. Demographics based on the occupation of the people of Laok Jang-jang Village

No	Group	Amount		Man		Woman	
		n	%	n	%	n	%
1	Not yet/not working	21	21.65%	9	9.28%	12	12.37%
2	Manage household	16	16.49%	0	0.00%	16	16.49%
3	Student	12	12.37%	6	6.19%	6	6.19%
4	Farmer/Grower	4	4.12%	4	4.12%	0	0.00%
5	Fisherman	2	2.06%	2	2.06%	0	0.00%
6	Private sector employee	9	9.28%	6	6.19%	3	3.09%
7	Bricklayer	1	1.03%	1	1.03%	0	0.00%
8	Trader	1	1.03%	0	0.00%	1	1.03%
9	Self-employed	31	31.96%	18	18.56%	13	13.40%

Based on the table above shows demographic data based on work. Not yet/not working 21.65%, managing the household 16.49%, students 12.37%, farmers 4.12%, fishermen 2.06%, private employees 9.28%, bricklayers 1.03%, traders 1.03%, self-employed 31.96%.

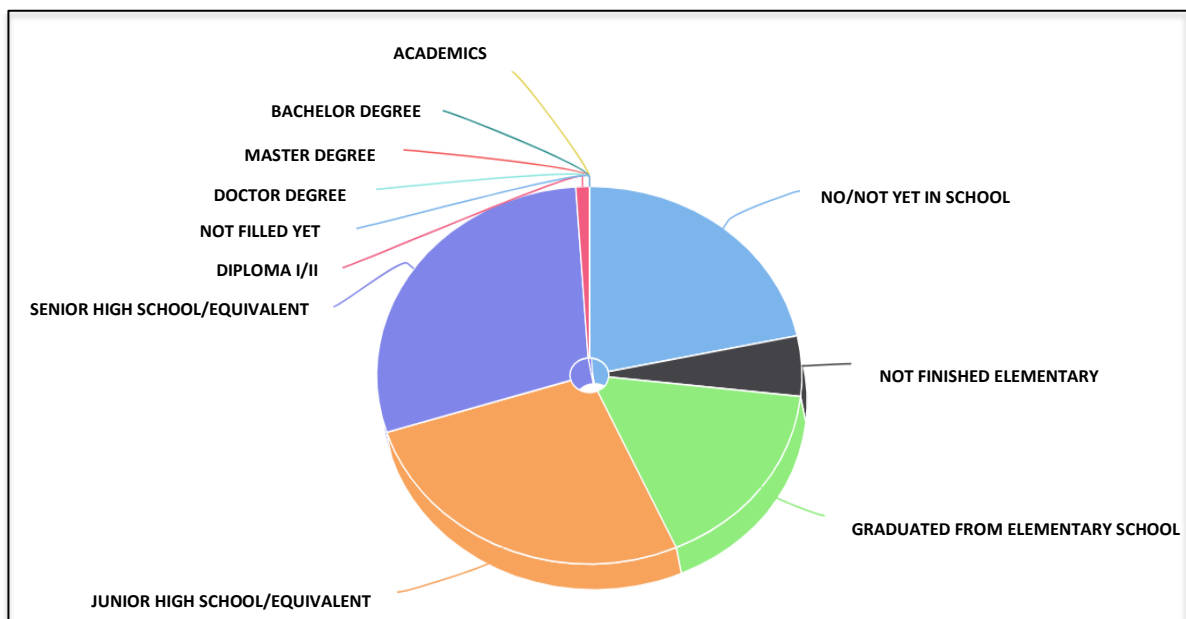


Figure 2. Demographic data based on the education of the people of Laok Jang-jang Village

Table 2. Data on Community Education in Laok Jang-jang Village

No	Group	Amount		Man		Woman	
		n	%	n	%	n	%
1	No/not yet in school	21	21.65%	7	7.22%	14	14.43%
2	Not finished elementary school / equivalent	5	5.15%	3	3.09%	2	2.06%
3	Graduated from elementary school/equivalent	16	16.49%	10	10.31%	6	6.19%
4	Junior High School/Equivalent	26	26.80%	8	8.25%	18	18.56%
5	Senior High School/Equivalent	28	28.87%	17	17.53%	11	11.34%
6	Diploma I/II	1	1.03%	1	1.03%	0	0.00%

Based on the table above, the demographic data shows that 21.65% of Laok Jang-Jang Village residents do not or have not yet attended school, 5.15% have not finished elementary school/equivalent, 16.49% have completed elementary school/equivalent, 26.80% junior high school/equivalent, 28.87% High School/equivalent, and 1.03% Diploma I/II.

Laok Jang-Jang Village is in Arjasa District, Sumenep Regency, East Java Province. Most of the population of this village work as entrepreneurs or Indonesian Migrant Workers (TKI) due to the limited employment opportunities in the village. However, Laok Jang-Jang Village has great potential to develop welding workshop entrepreneurs. The need for welding power is sufficient for welding fences and also welding in motorbike workshops. Therefore, welding training for villagers is needed, starting from theory to finishing the welding process. This activity aims to improve capabilities and open business opportunities for the people of Laok Jang-Jang Village.

2. Materials and Methods

Flux Cored Arc Welding (FCAW), often called double shield welding, supplies a filler electrode mechanically into the electric arc created between the tip of the filler electrode and the base metal. Electrodes in FCAW welding are made of thin metal, rolled cylindrically and filled with flux according to its use. FCAW welding combines SMAW, GMAW, and SAW welding processes. This welding power source uses AC or DC electric current from a power plant, transformer, or rectifier. The protective gas also uses CO₂ gas.

FCAW is similar to the GMAW welding process, using solid and tubular electrodes fed continuously from a coil. The welding wire is fed through the gun or torch while protecting the arc between the electrode tip and base metal. This welding uses welding wire that has flux powder in the stem. The granules in this wire core create some or all of the required shielding gas. In contrast to GMAW, where all shielding gas comes from outside sources.

Welding Flux Cored Arc Welding (FCAW) uses the heat energy obtained from an electric arc to join two pieces of metal. The electric arc is centred between the pieces of metal to be joined using a welding wire that is continuously pulled, causing the metal and wire to melt together and produce a welded joint. FCAW welding is better used to join metal materials with high thicknesses and is suitable for outdoor use. The shielding on FCAW welding resulting from the filler cable can withstand high winds, and when used without an external shielding gas, it can be used anywhere. FCAW welding has many advantages, such as flexibility, higher wire position and good stability, so the high-speed welding process is very good without reducing the weld quality.

This welding training was held in Laok Jang-Jang Village, Arjasa District, Sumenep Regency, East Java Province. The welding machine used is an FCAW welding machine because this welding is easy and good for all welding positions. However, it should be noted that the composition of the electrode flux must match the material to be welded. The ease of obtaining high-quality welding results and the high success rate make FCAW welding widely used in construction. The welding process can also be outdoors, even in high wind conditions.

The training method includes providing material on Occupational Health Safety (K3), basic FCAW welding, and continued welding practice.

Training Stages Las Flux Cored Arc Welding (FCAW) in Improving Welding Skills can be seen in the table below:

Table 3. Stages of Training Activities

No	Time	Activity Material
1	07.30-07.45	Opening
2	07.45-08.45	Material K3
3	08.45-09.45	Welding Material
4	9.45-12.00	Welding practice
5	12.00-13.15	It's a LITTLE
	13.15-15-15	Continue welding practice
7	15.15-16.00	Evaluation and Discussion
8	16.00-16.30	closing

3. Results

Training results as Flux Cored Arc Welding (FCAW) in improving welding skills in Laok Jang-Jang Village, Arjasa District, Sumenep Regency, showed a major impact on village communities in improving and developing skills in the welding field. This training program is an effort to develop and prepare human resources in an increasingly advanced era, especially in developing skills in a field.

This training program is a joint effort to improve abilities, skills, mastery of welding skills, and knowledge. It is hoped that the training participants will be more skilled and able to carry out their responsibilities better according to the standards. In this training, the villagers learned about welding and occupational safety and health in the welding process. The training participants comprised ten people, of which 3 were recent high school graduates, and two were still in school. This welding training was carried out for one day.

In this training, there are still a few obstacles for the trainees when doing welding. Some participants needed help understanding the current used when welding. Therefore, assistance during welding is carried out to provide more knowledge so that participants can discover mistakes when carrying out the welding process. The results of the welding that has been done show pretty good results. This can be seen in the welding results using the ASTM A36 material below.



Figure 3. Welding Training Process





Figure 4. Welding results that have been carried out

From the results of the welding training, it can be seen from the welding results shown in Figure 4 that the welding results are good, and there are no welding defects. This shows that the trainees experienced an increase in skills in welding.

4. Discussion

Based on the training described above, it can be analyzed that training Flux Cored Arc Welding (FCAW) in improving welding skills in Laok Jang-Jang Village, Arjasa District, Sumenep Regency, significantly impacted the village community. This training aims to improve the abilities, skills, mastery of welding skills, and knowledge of the trainees. In addition, this training also provides knowledge about occupational safety and health in the welding process.

From the results of the training that has been conducted, the training participants experienced an increase in skills in welding. This can be seen from the good welding results, and there are no welding defects. However, the trainees still need help such as understanding the current welding. Therefore, assistance during welding is carried out to provide more knowledge so that participants can discover mistakes when carrying out the welding process.

Thus, training in Flux Cored Arc Welding (FCAW) in improving welding skills in Laok Jang-Jang Village, Arjasa District, Sumenep Regency, is a program that is beneficial for the village community. This training not only improves the skills of the trainees in the field of welding but also provides knowledge about occupational safety and health in the welding process. However, assistance and guidance are still needed so the trainees can better understand and master welding techniques properly.

5. Conclusions

The aforementioned description leads to the conclusion that, despite the fact that the Flux Cored Arc Welding (FCAW) process has a number of parameters that must be modified to meet welding requirements in order to produce good weld results with the desired quality, training in FCAW has improved the welding skills of the Laok Jang-Jang Village community. Nonetheless, the trainees' performance was excellent. This can be seen from the welding results that there are no faults. This demonstrates that before performing the Flux Cored Arc Welding (FCAW) welding process, the trainees applied the supplied material.

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