ISSN:2775-8508
E-ISSN:2797-1058

Proceeding Universitas Muhammadiyah Gresik Social Science and Humanities Internasional Conference (UMGCINMATIC)

Welding Product Quality Improvement Using The Seven Tools Method

Agin Viakri Dagmar[1] , Pangki Suseno[2]

Faculty of Engineering, Mechanical Engineering, Universitas Muhammadiyah Gresik[1]
Faculty of Science and Technology, Industrial Engineering, Universitas Bhinneka PGRI[2]

Email: aginviakridagmar@gmail.com*

ABSTRACT

PT. SRM is an organization that provides steel construction services. Welding is the most essential step in the production of construction materials. A significant number of defective welds is a factor that contributes to high production costs. The Seven tools technique is a tool that assists quality control and 5W+1H analysis in the development of plans to address existing product issues. This study's objective is to identify the types of defects, their underlying causes, and the steps taken to reduce the amount of defects in order to increase production cost efficiency. According to the results of the discussion, the total production was 13,309 units with 2,767 faults. The flaw with the highest percentage is the porosity defect, which is equal to 26.7%. Improvements include providing operator training to improve machine operating skills, periodically inspecting materials to maintain material quality, performing periodic machine repairs to prevent a decline in production quality, and compiling quality and accurate standard operating procedures for welding techniques.

Keywords: Welding; Seven tools; Defect; Quality.

1. INTRODUCTION

The practice of quality control is extremely vital for companies, and it must be carried out in order for these companies to discover irregularities in the production process and take corrective action in order to limit or prevent damage to the smallest extent feasible. As a result of production irregularities, the company will suffer significant losses, both in terms of the quantity and the quality of its products (Rosihin et al., 2017).

Product quality control is a method of achieving the optimum results in a manufacturing process. To establish client trust, the manufacturing industry will always prioritize product quality through product warranties (Harahap & Parinduri, 2018). To be able to keep the quality of the product consistent, an effective quality control system is essential (Junianto et al., 2021). This system is required to begin by identifying each and every factor that may be contributing to a problem before moving on to the next step, which is to make adjustments using the approach of seven tools (Matondang & Ulkhaq, 2018) and 5W+1H analysis.

The Seven Tools technique is a statistical tool that identifies the fundamental factors contributing to quality issues in order to facilitate quality management and improvement (Hairiyah et al., 2020). Check Sheets, Histograms, Pareto Charts, Fishbone Diagrams, Control Charts, Flowcharts, and Scatter Diagrams are the seven fundamental tools that are used in quality control (Abdel-Hamid & Abdelhaleem, 2019). Meanwhile, the 5W+1H analysis is utilized to develop plans to address existing product issues. The 5W+1H analysis comprises what problems will be addressed, why it has to be repaired, where the repair location is, when the corrective action is carried out, who is the party responsible for the repair, and how strategies to overcome problems that will be carried out corrective actions (Somadi et al.,

2020).

PT. SRM is a steel construction company that has earned the trust of BUMN and other multinational corporations as a steel construction subcontractor. A very high level of product defects was discovered during the welding work process; several factors became obstacles that caused product defects. The high number of product defects leads to poor product quality. If a defective product is not identified by the company and reaches consumers, the level of satisfaction with the product may decrease (Suseno & Sudarso, 2021).

Based on the description of the phenomenon of the problems faced by companies regarding the high number of defects in welding products, the approach taken is to use the seven tools method to identify the causes of product defects.

The purpose of this research is to identify the factors that contribute to product defects and make recommendations for improvements to improve the quality of welding products.

2. METHOD

The research began with the collection of literature studies and observations through interviews, as well as the collection of production data and product demand over a 12-month period, beginning in July 2019 and ending in June 2020. This data is retrieved to determine the amount of production, the number of defects, and the types of defects in welding products. The collected data is then processed using seven tools, with the following stages: Check Sheets, Histograms, Pareto Charts, Fishbone Diagrams, Control Charts.

3. RESULT AND DISCUSSION

The method of the seven tools is used to detect difficulties that arise throughout the production process. This allows for the identification of factors that produce flaws, which in turn allows for the identification of elements that can reduce the quality of welding products. The results and discussion are as follows:

3.1. Check Sheet.

A check sheet is used to record measurements. Check sheets are used in the data collection and analysis processes. Furthermore, knowing the problem area based on the frequency of the type or cause can help you decide whether or not to repair it. Table 1 shows the causes of welding defects from July 2019 to June 2020.

Table 1. Data of Defect Type

No	Month	Products (pcs)	Type of defect				
			Undercut	Porosity	Slag	Crack	Spatter
1	July 2019	654	44	54	23	29	23
2	August 2019	1044	43	52	28	34	40
3	September 2019	985	50	53	36	32	31
4	October 2019	743	26	47	23	34	22
5	November 2019	894	28	42	26	29	31
6	December 2019	1219	37	46	36	39	39
7	January 2020	1208	36	62	42	54	36
8	February 2020	1325	68	75	45	43	46
9	March 2020	1313	79	86	51	47	52
10	April 2020	1524	76	83	43	49	49

11	May 2020	1208	77	62	37	53	38
12	June 2020	1191	75	69	41	55	43
	Total	13,309	649	738	431	498	451

3.2. Pareto Charts.

This pareto chart is useful for determining the number and proportion of each defect category that is most frequently.

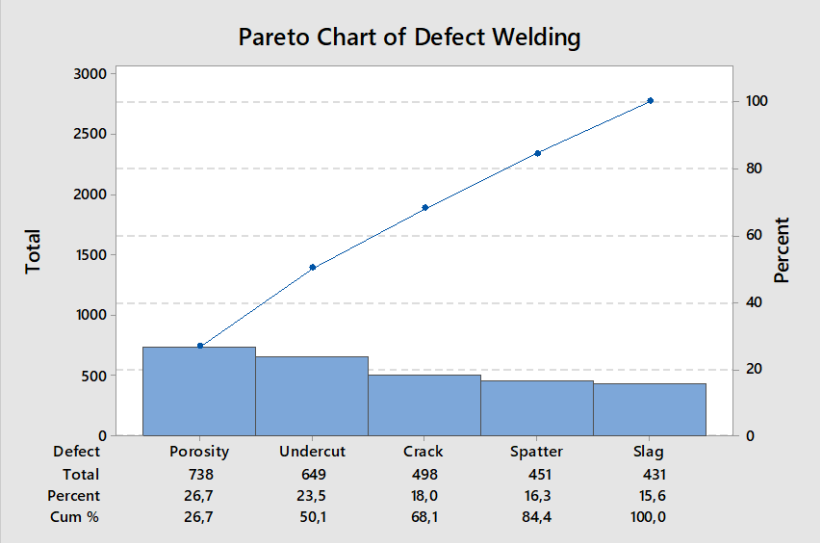

Figure 1. Pareto Chart of Defect

The picture above shows the highest rate of product defects with the porosity type of 26.7%. Followed by 23.5% undercut, 18.0% crack, 16.3% spatter and 15.6% slag.

3.3. Fishbone Diagram

Fishbone diagrams are used to identify the sources of product defects, with a focus on porosity problems, the most severe type of defect.

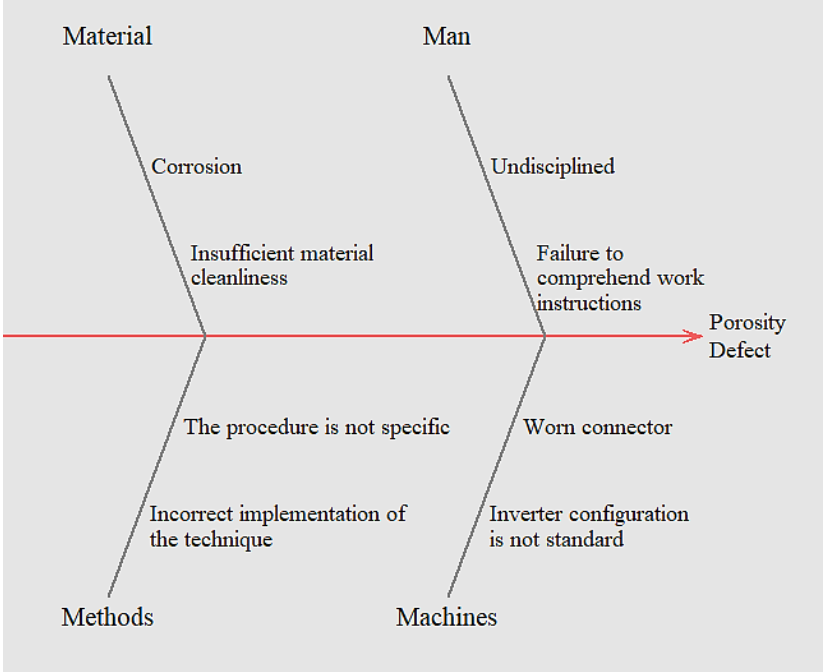

Figure 2. Fishbone Diagram for Porosity

The elements that lead to product defects may be observed from the results of the fishbone graphic above and are described as follows:

a. Man : because employees are not disciplined and fail to understand existing work instructions.
b. Material : because the material used is corrosion and the area to be welded is less clean.
c. Machine : because the connector is worn and the inverter configuration is not standard.
d. Methods : because procedure is not specific and incorrect implementation of the technique.

3.4. 5W+1H Analysis.

The following step is to fix the welding process, which is done to limit the possibility of flaws occurring. Based on the identification findings from the fishbone graphic, improvements were made. The proposed enhancements are implemented using the 5W+1H idea approach.

Table 2. Improving Welding Quality Through Application

Factor	Description	Action
Man factor : 1. Undisciplined 2. Failure to comprehend work instructions	What is the purpose of the repair?	Welding fault reduction
	Why did they fix it?	The human factor is the most important determinant of product quality.
	Where is this activity carried out?	Corrective action in the welding division

	When was the fix completed?	Gradually, according to a set schedule
	Who will work on the improvement plan activities?	Welding division workers
	How is it carried out?	Provide periodic training to improve abilities and issue warnings to disobedient operators.
Material factor: 1. Corrosion 2. Insufficient material cleanliness 3. Moist electrode	What is the purpose of the repair?	Reduce product defects
	Why did they fix it?	A large number of faults were discovered as a result of welding product.
	Where is this activity carried out?	Corrective action in the welding division by Quality Control (QC)
	When was the fix completed?	Gradually, according to a set schedule
	Who will work on the improvement plan activities?	Quality Control operators inspect raw materials that will be processed for welding.
	How is it carried out?	Quality Control thoroughly inspects the welding process results.
Machine factor: 1. Inverter configuration is not standard 2. Worn connector	What is the purpose of the repair?	Produce welding in accordance with company standards, the operator constantly checks and maintains the machine
	Why did they fix it?	Resulting in loss of processing time
	Where is this activity carried out?	Corrective action in the welding division
	When was the fix completed?	Gradually, according to a set schedule
	Who will work on the improvement plan activities?	Welding division workers
	How is it carried out?	Repair of damaged machines in accordance with SOP

Methods factor: 1. Incorrect implementation of the technique 2. The procedure is not specific	What is the purpose of the repair?	Reduce the occurrence of welding defects and improve work procedures
	Why did they fix it?	To decrease the number of welding problems
	Where is this activity carried out?	Corrective action in the welding division
	When was the fix completed?	Gradually, according to a set schedule
	Who will work on the improvement plan activities?	Welding division workers
	How is it carried out?	Make quality and accurate SOPs for welding techniques.

Following the 5W+1H analysis, the following suggestions for enhancements can be made: The proposed improvements include performing routine equipment maintenance and repair using a comprehensive preventive maintenance methodology. In order to anticipate the arrival of raw materials that are not of the expected quality, each arrival of raw materials is rigorously inspected. Data is gathered and reported as material for future improvements based on inspection findings on any incidence of product flaws during production.

4. CONCLUSION

The analysis results show that the welding product has 5 categories of defects, with porosity accounting for the highest defect rate of 26.7%. Proposed 5W+1H improvements include providing operator training to improve machine operation skills, checking materials on a regular basis to maintain material quality, performing periodic machine repairs to avoid decreasing production quality, and developing quality and accurate SOPs for welding techniques.

5. REFRENCES

Abdel-Hamid, M., & Abdelhaleem, H. M. (2019). Improving the Construction Industry Quality Using the Seven Basic Quality Control Tools. *Journal of Minerals and Materials Characterization and Engineering*, *07*(06), 412–420. https://doi.org/10.4236/jmmce.2019.76028

Hairiyah, N., Amalia, R. R., & Nuryati, N. (2020). Pengendalian Kualitas Amplang Menggunakan Seven Tools di UD. Kelompok Melati. *AGROINTEK*, *14*(2), 249–257. https://doi.org/10.21107/agrointek.v14i2.6055

Harahap, B., & Parinduri, L. (2018). *Analisis Pengendalian Kualitas dengan Menggunakan Metode Six Sigma*. *13*(3), 9.

Junianto, D., Arifianti, E. R., & Narto, N. (2021). Peningkatan Kualitas Produk Shortening Menggunakan Pendekatan Dmaic Six Sigma di PT Best Gresik. *Jurnal Rekayasa Sistem IndustrI*, *7*(1), 54–59. https://doi.org/10.33884/jrsi.v7i1.4545

Matondang, T. P., & Ulkhaq, M. M. (2018). Aplikasi Seven Tools untuk Mengurangi Cacat Produk White Body pada Mesin Roller. *Jurnal Sistem dan Manajemen Industri*, *2*(2), 59. https://doi.org/10.30656/jsmi.v2i2.681

Rosihin, R., Mujaddid Ulinnuha, L., & Cahyadi, D. (2017). Analisis Pengendalian Kualitas Super Absorbent Polymer Dengan Menggunakan Metode Six Sigma. *Jurnal Sistem Dan Manajemen Industri*, *1*(1), 19. https://doi.org/10.30656/jsmi.v1i1.170

Somadi, S., Priambodo, B. S., & Okarini, P. R. (2020). Evaluasi Kerusakan Barang dalam Proses Pengiriman dengan Menggunakan Metode Seven Tools. *Jurnal INTECH Teknik Industri Universitas Serang Raya*, *6*(1), 1–11. https://doi.org/10.30656/intech.v6i1.2008

Suseno, P., & Sudarso, I. (2021). *Peningkatan Kualitas Produk Gamis Anak di Pt.KKI dengan Metode Quality Function Deployment dan Six Sigma*. 7.