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Analysis of Quality Control of Steel Plate Products with Six Sigma Method at PT. Krakatau Posco

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***Abstract*—At PT. Krakatau Posco, the Plate Rolling section has three sectors namely the mill finishing sector, shearing line and finishing line. The study was conducted at the shearing line, aiming to determine the factors causing damage to the resulting steel plate products. The study was conducted using the Six Sigma method, as an effort to improve the quality produced, which consists of DMAIC (Define, Measure, Analyze, Improve, and Control). At the problem solving stage, the application of 5W + 1H (What, Who, Where, When, Why, How) is used. These six questions are questions that can help solve problems and generate ideas in improvement efforts. By following the steps in the Six Sigma method and the 5W + 1H implementation, it is known that the DPMO value is 6194 tons, with an σ value above an average of 4.03, while cutting defect is one of the company's problems with the largest defect rate and efforts are needed minimizedefect rate of 7,272 tons, second with a total number of scratch defects of 5,748 tons and third marking defects of 5,595 tons within 12 months. To reduce the level of defective products (defects) in the production process, it is necessary to improve the factors affecting the quality of production including, human (employees), materials, machinery, methods and the environment.**

Keywords: DMAIC, steel plate, Six Sigma, quality, 5W + 1H

I. INTRODUCTION

PT. Krakatau Posco is one of the Banten Cilegon regional steel companies, it is the largest steel industry in Asia which has quite a high demand, therefore quality is one of the important factors that must be maintained by PT. Krakatau Posco, to maintain the competitiveness and loyalty of their consumers.

But in reality, there are still problems found in the production process in achieving good quality levels. this can be seen from the existence of products with specifications outside the quality standards set by PT. Krakatau Posco. and categorized as defective defect products, namely Scratch Defect (defects due to the delivery process), Cutting Defect and Marking Defect.

PT. Krakatau Posco itself still has difficulty in achieving the maximum product target because there are still many problems in the production process so that the resulting product specifications have variability (diversity) which results in not achieving the production target, the use of raw materials is not optimal so that there is a waste of production costs, decreased company productivity and the ability to meet customer satisfaction is lower.

The following defect plate products in Rolling Plate within one year period May 2018 - April 2019, for example from a total production of 1,004,500 tons of plates there are 18,615 tons of plates with a percentage of 1.8% defects in the final product, with the criteria of scratch defects 5,748 tons, defect cutting 7,272 and defect marking 5,595 tons in the final product. Seeing the conditions and the importance of guarantee of the quality of a product, it is necessary to do a strategy that can provide quality assurance to the quality of a product, that is a strategy that can control and improve the quality of product quality.

Therefore conducted research to measure, analyze and make quality improvements at PT. Krakatau Posco Tbk. Cilegon work to reduce defect rates, using the six sigma method (Define, Measure, Analyze, Improve, Control) and 5W + 1H (What, Why, Where, When, Who + How). Based on the description above, the researcher took the title "Analysis of Quality Control of Steel Plate Products with the Six Sigma Method (DMAIC) at PT. Krakatau Posco Tbk".

II. METHOD

In the preliminary stage, the research topic is determined, identifying the problem, formulating the problem, and determining the scope of the research. this is done by conducting a literature study to understand the topic of steel plate quality, discussions with mentors, and case studies in the field conducted directly on the object under study, that is looking for data relating to steel plate defect products and interviewsto related parties in the company, as well as collecting and studying documents or archives in the company.

At the data processing stage, the data that has been collected is processed using the six sigma DMAIC method.

III. RESULTS

A. Define

Defects that occur in steel production are defect scratch, defect cutting and defect marking.

1) Scratch defect

Defects that occur due to dirt on the surface of the plate or the presence of foreign objects, usually in the form of spots or spots on the surface of the top or bottom plate.

2) Cutting defects

This steel defect occurs due to a knife that has been abrased or there is an error reading the gap between the monitor screen and the actual blade.

3) Marking defects

This defect occurs because the paint or side marking results are not good.

B. Measure

Measurements in the measure stage are divided into two stages including the Control Chart Analysis and the sigma level measurement and Defect Per Milion Opportunities (DPMO).

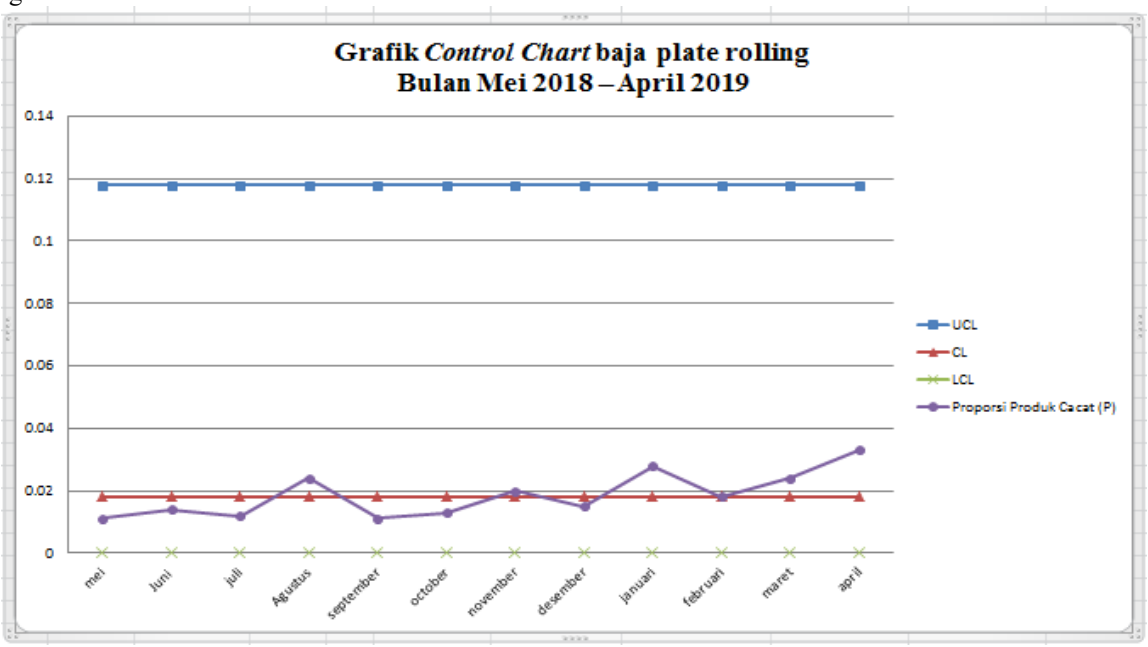

Fig.1. Grafik Control Chart

TABLE 1. SIGMA LEVEL MEASUREMENT AND DPMO (*DEFECT PER MILLION OPPORTUNITIES*)

No	Month	Year	Amount of production (n)	Number of defective products (np)	DPU	CTQ	DPO	DPMO	Sigma Level
1	May	2018	85000	935	0.011	3	0.00366	3666	4.19
2	June	2018	83000	1162	0.014	3	0.00466	4666	4.10
3	July	2018	85500	1026	0.012	3	0.00400	4000	4.15
4	August	2018	85000	2040	0.024	3	0.00800	8000	3.90
5	September	2018	82000	902	0.011	3	0.00366	3666	4.17
6	October	2018	85000	1105	0.013	3	0.00433	4333	4.13
7	November	2018	82000	1640	0.020	3	0.00666	6666	3.98
8	December	2018	87000	1305	0.015	3	0.00500	5000	4.07
9	January	2019	85000	2380	0.028	3	0.00933	9333	3.86
10	February	2019	83000	1494	0.018	3	0.00600	6000	4.04
11	March	2019	80000	1920	0.024	3	0.00800	8000	3.90
12	April	2019	82000	2706	0.033	3	0.01111	11000	3.85
	Total		1004500	18615					
	Average							6194	4.03

C. Analyze

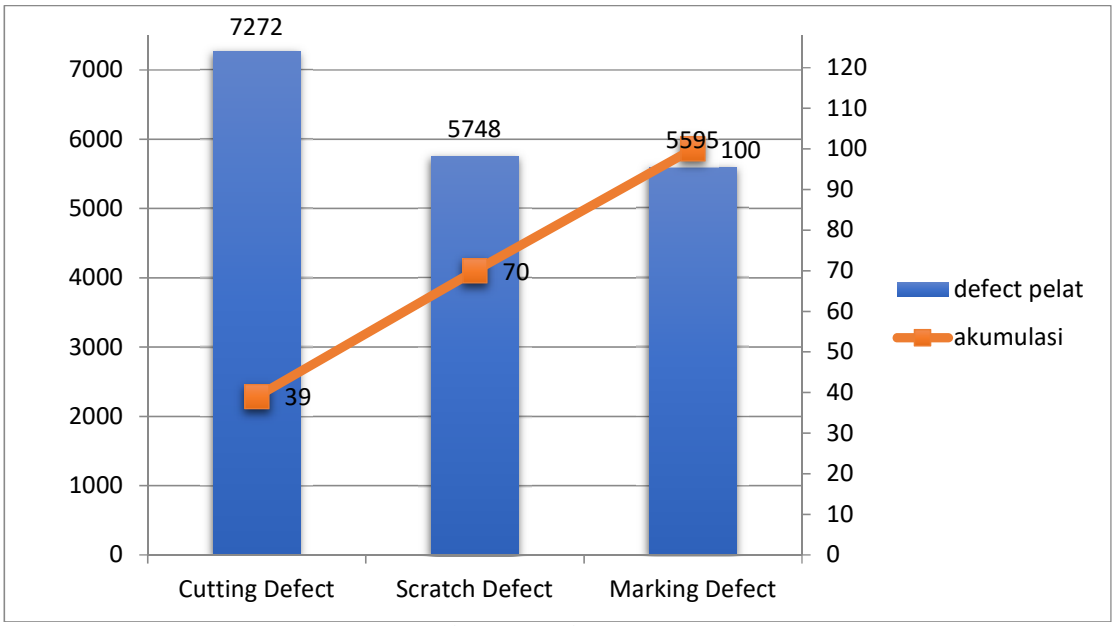

Fig.2. Pareto Diagram

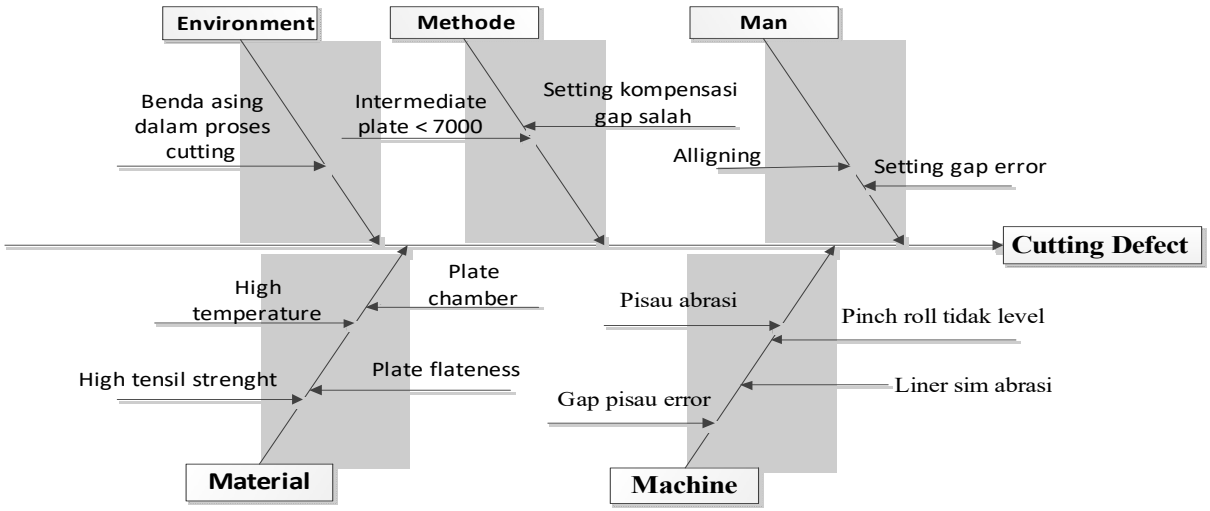

Fig.3. Fishbone Diagram

D. Improve

TABLE 2. PROPOSED IMPROVEMENTS

Unsure	Causative Factor	Normal Standard	Proposed Corrective Action
Machine	1. Sim aberration liner knife	1. Sim liner knife there is no gap between the liner.	1. Replacing the sim liner knife and intensive care.
	2. Knife abrasion	2. A normal knife has a gap value between a surface of 0,03 mm dan a flat knife surface.	2. Replacing abrasion and damaged knives with new ones then there is a need to check for gaps in the lifetime or left time so that there is no down time during production.
	3. Gap error	3. The actual normal gap and the same system. Ex: gap system 2, but actually 4.	3. Check the actual gap periodically and calibrate the system.

Unsure	Causative Factor	Normal Standard	Proposed Corrective Action
Method	1. Instruction of work is not clear. 2. The wrong aligning plate the cutting process on a double side shear machine.	1. Work instructions are given by superiors through a brief brefing and written on the work operasional standard documents. 2. Both sides of the plate are the same when cutting a double side shear machine.	1. Work instructions are given in writing accompanied by detailed verbal explanations, namely by carrying out regular briefings at the beginning and end of the work. 2. Ensure that the cutting edge of the line indicator on the bridge is the same as on the DSS machine.
Man	1. Neglectful 2. Lack of skill 3. Lack of supervision 4. Lack of motivation	1. Work must be carried out in accordance with SOP (Standard Operating Procedure) work. 2. Know everything that is related to the work he is doing. 3. Employees are obedient and obedient in carrying out work regulations, both in the form of oral and written from groups and organizations. 4. Supervise asan against employees during working hours. 5. Motivate employees so that employees can work with enthusiasm and responsibility.	1. Work instructions are given in writing accompanied by detailed verbal explanations, namely by carrying out regular briefings at the beginning and end of the work. 2. Ensure that the cutting edge of the line indicator on the bridge is the same as on the DSS machine.

Unsure	Causative Factor	Normal Standard	Proposed Corrective Action
Environment	1. Hot air 2. Dusty environment	In accordance with the requirements of industrial work environment health stipulated by the government (Ministry of Health of the Republic of Indonesia): - Temperature: 18-28 0C and Humidity: 40% - 60%. - The maximum dust content in room air in an average measurement of 8 hours is 0.15 mg / m^3.	1. Adding facilities in the production room to reduce the impact of hot air caused by machinery and weather, for example by adding fans in every corner (the temperature outside the plate rolling working environment 38 -39 degrees centigrade). 2. Installing a wet filter, is a tool used to clean dirty air by spraying water from the top of the tool, while dirty air from the bottom of the tool. When dirty air comes in contact with water, dust will also be carried down by water spray down. If you want better results, you can combine silicone setters with a wet filter. Combining these two tools produces a dust catching device called a wet filter cyclone precipitator. (dust value in the field according to HSE data 0.18mg / m^3.

E. Control

Control is the fifth stage of the six sigma method which emphasizes the documentation and dissemination of the actions taken include:

- Make improvements to the machine on a scheduled and periodic basis.
- Perform corrective actions appropriately through constraints that have an impact on quality.
- Re-examine the documents and procedures used by the company.
- Supervision before and after the production process.
- Production operators understand the procedures established by the company and play an active role in carrying out their responsibilities.

IV. CONCLUSIONS

Based on the results of the analysis of research conducted on steel plate production at the shearing line, PT. Krakatau Posco, the conclusions can be drawn as follows: first, based on the Pareto diagram the number of steel plate final products is obtained by the amount damage of 18,615 tons with the largest damage in the type of cutting defect of 7,272 tons, the second scratch defects are 5,748 tons, and the third is the defect marking of 5,595 tons. All this damage is affected by humans (employees), the environment, machinery, and method. Second, through data and analysis conducted at PT. Krakatau Posco, the amount obtained production from May 2018 - April 2019 amounted to 1,004,500 tons, and the number of products defect amounted to 18,615 tons. Based on data analysis and processing known level sigma above average is 4.03 with sigma value> 4.03 there are 7 months, and <4.03 there is 5 month. with a probability of flawless worth 99.2%, the probability of damage is 6194 tons for one million productions (DPMO), this needs to be improved so that it can reduce the number of production costs at PT. Krakatau Posco. Third, based on the analysis of the causative factors so that there is ineffectiveness shearing line product defect control is due to machine shearing line which does not prevent and scale-out the DSS and blade liner sim human factors due to neglect, undisciplined and lack of knowledge or skills, factors uncomfortable environment due to hot temperatures and dusty air, a method factor due to lack of work instructions and lack of coordination between employees.

REFERENCES

[1] Ardita, Fika Aras dan Sukardi. 2012. *Analisis Pengurangan Jumlah Cacat pada Industri Kertas dengan Pendekatan Lean Six Sigma*. *E-Jurnal Agroindustri Indonesia Juli 2012.* Vol. 1 No (1). 2252 – 3324.

[2] Baroto, Teguh. 2002. *Perancangan dan Pengendalian Produksi*. Jakarta: Penerbit Ghalia Indonesia.

[3] Cavanag, Roland R, Peter dan Robert P Neuman. 2000. *The Six Sigma.* Yogyakarta: Penerbit Andi.

[4] Ghiffari, Ibrahim, Ambar Harsono dan Abu Bakar. 2013. *Analisis Six Sigma untuk Mengurangi Jumlah Cacat di Stasiun Kerja Sablon*. *Jurnal Online Instiut Teknologi Nasional (ITENAS) Bandung 2013.* Vol. 1 No. (1). 2338 – 5081.

[5] Goetsch, D. L dan Davis, S. 1995. *Implementing to Total Quality.* Prentice Hall International, Inc.

[6] Han, Seung Heon, Myung Jin Chae, Keon Soon Im, Do Dong Ryu. *Six Sigma-Based Approach to Improve Performance in Contruction Operations*. Journal of Management in Engineering. Volume 24 Issue 1-January 2008.

[7] Juran, J.M. 1992. *Juran on Quality by Design*. New York: Free Press.

[8] Kumar, Sameer, Michael Sosnoski. *Using DMAIC Six Sigma to Systematically Improve Shopfloor Production Quality and Costs*. International Journal of Productivity and Performance Management. ISSN: 1741-0401.

[9] Nasution, M.Nur. 2015. *Manajemen Mutu Terpadu (Total Quality Management)*. Bogor: Penerbit Ghalia Indonesia.
[10] Pande, Neuman, Roland R. Cavanagh. 2002. *The Six Sigma Way Bagaimana GE, Motorola dan Perusahaan Terkenal Lainnya Mengasah Kinerja Mereka.* Yogyakarta: Andi.
[11] Pete & Holpp. 2002. *What is Six Sigma*. Yogyakarta: Andi.
[12] Susetyo, Joko. 2011. *Aplikasi Six Sigma DMAIC dan Kaizen sebagai Metode Pengendalian dan Perbaikan Kualitas Produk*. Jurnal Teknologi. Vol. 4 No (1). 61 – 53.
[13] Tjiptono, Fandy dan Diana Anastasia. 2003. *Total Quality Management.* Yogyakarta: Penerbit Andi.
[14] Zhang, Min, Wei Wang, Thong Ngee Goh, Zhen He. *Comprehensive Six Sigma Application: a Case Study*. Journal Production Planning and Control, The Management of Operation. Volume 26, 2015 – Issue 3.