IDENTIFICATION OF THE MOST POTENTIAL DEFECTS AND CAUSED BY USING METODE FAILURE MODE AND EFFECT ANALYSIS (FMEA) IN PT X

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ABSTRACT

This paper presents application of failure mode and effect analysis (FMEA) for production plant of sheeter knives. FMEA is quality and realibility tool, which requires identifying failure modes of a specific product or process. In conducting FMEA, three parameters (severity, occurrence and detection) are utilized to describe each failure mode by rating on a 1-10 scale. Severity rating is the seriousness of the effect of a failure to the next component, subsystem, system, or customer. Occurrence rating is the likelihood or frequency of the failure occurring. Detection rating is the inability to detect the failure. Criticality assessment of FMEA is evaluated by developing a risk priority number (RPN). RPN is the product of the severity (S), occurrence (O), and detection (D) ratings. By ranking the priorities for corrective action according to the respective effects of the failures, the chance of the failure can be reduced or eliminated.

Keywords: *failure mode and effect analysis (FMEA), severity, occurrence, detection, risk priority number (RPN)*

1. INTRODUCTION

The quality of a product is one of the key for the industry to consumer loyalty keep watch of its products, and seize market share from industry producing similar products with.PT X is one of Indonesia's manufacturing companies that specializes in cutting knife industry. To ensure the quality of the products, in producing the knife piece, the company has specialized in the production of reference piece knife. Although this has been done on the reality on the ground, there are still defects or failures that occur during the production process is in progress. One of them is the distance between the holes on the knives cut with the other holes are not precise.

By looking at the proportion of the many defects that occur, which eventually can lead to negative things that are not desirable and will bring the company a bad impact on the company, the company is important to look at and prioritize the aspects of quality control.

2. BASIC THEORY

A quality control are the activities and management techniques through the measurement of the quality characteristics of the output (goods / services), then compare the results of measurements with the desired output specifications of the customer, and take appropriate corrective action if found in the difference between actual performance standard. To achieve good quality, of course, quality control is necessary. Quality control can be done through two approaches, namely:

a. On-Line Quality Control
Is the quality control activities conducted during the manufacturing process took place by using Statistical Process Control (SPC). The nature of the On-Line QC is a reactive control measures or actions after the production activities of walking. That is, if the product does not meet the expected specifications, then the corrective action process should be done.

b. Off-Line Quality Control
Quality control is done before the production process or quality control is preventive. With its preventive measures in the possibility of product defects and quality problems can be resolved before the production run. Reduction in product defects will reduce scrap and product failure. The purpose of the Off-Line QC is to optimize product design and process support Ranka dalan On-Line QC.

In general there are 4 steps in quality control, namely:

1. Setting the standards: Standards established standards covering raw materials, cost, performance, security and reliability required for these products.
2. Assessing suitability: The point is to compare the suitability of the products manufactured or services offered by the standards that have been made or determined.
3. Corrective action if necessary: The point is to correct the problem and find the cause by factors that include marketing, design, engineering, production, and maintenance that affect user satisfaction.
4. Planned improvements: This is to develop a continuous effort to improve the standard of raw materials, cost, performance, security and reliability.

2.1 **Cause and Effect Diagram**

Cause and effect diagram (Cause and effect diagram) in 1976 developed by Kaoru Ishikawa who works to determine the cause of a problem. Cause and effect diagram can be also called fishbone diagrams (fish bone) or the Ishikawa diagram name.

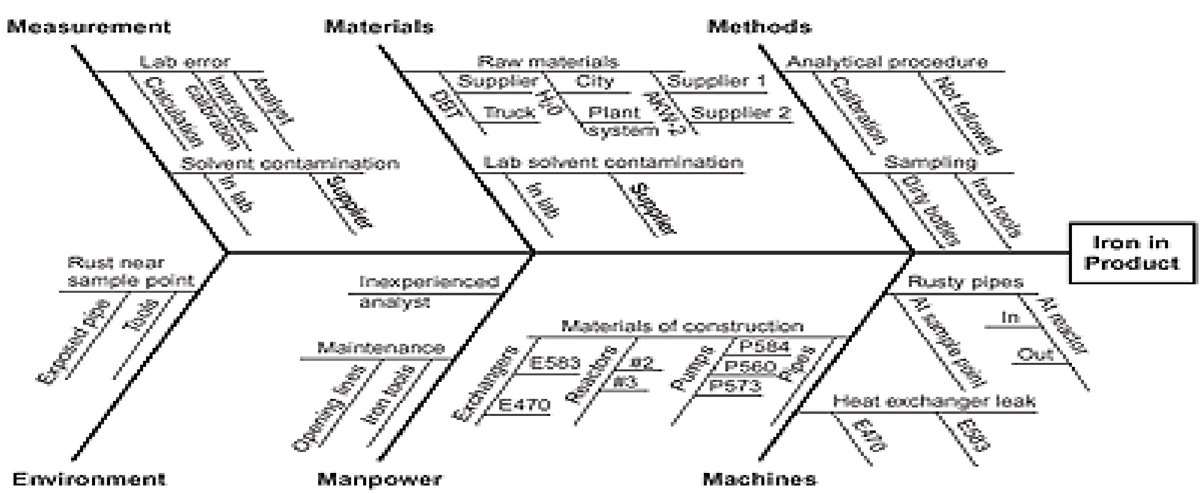

Figure. 1. Cause and effect Diagram

Cause and effect diagram is used to identify the causes of an effect, so it can be determined actions necessary to make improvements. The effect is placed on the right in the "fish head", and contributing factors to the left at the "fish bone". Major causes are further subdivided into several minor causes. To determine the cause of this minor is required brainstorming with interviews from the various parties involved.

3. Research Methodology

Research begins with field research so that the problems there, and the condition of the company that will be examined, including an introduction to the use of production machines, the production process in the manufacture of the knife cut, the material used, and production data for three months. The processed data is data which is attribute data of defects that occur 3bulan submarine, the month of January 2009 until March 2009. The data obtained by observation. Observations made as many as 17 times in January, 20 times in February, and 19 times observations in March.

Further research literature to determine types of defects and causes most occurring in a process to obtain the basic theory to answer the problems that arise. The tool used is by using FMEA (Failure Mode and Effect Analysis) is a tool to determine the mode used defects that often arise in a production process and the causes and effects caused by knowing the value or score by multiplying the three inputs, namely severity, Occurrence and Detection of these scores will be used for priority handling to be resolved first. Input FMEA:

1.Severity

Severity is an assessment of the seriousness of the effects. In every sense of failure that arise will be assessed how much the level of seriousness. Severity values are described only at the level of seriousness of the effect itself.

2.Occurance

Occurance used to measure how often a result or effect because it appears certain AUSE. Moreover, it can also to measure how often a failure

3.Detection

Detection is assumed as failures that have occurred and how likely detection methods can detect the failure.

Each of the three inputs on the FMEA has become a reference value to serve as input values that can be seen in Table 1.2 and the 3 scores will be used to produce an output value of RPN (Risk Priority Number) by the formula:

$$\text{RPN} = \textit{Severity x Occurance x Detection}$$

$$1 \leq \text{RPN} \leq 1000$$

Table 1. Severity ratings on the FMEA (CEP-ASTRA)

Severity (S)		
Rating	Definition	Description
10	Hazardous without warning	Very high severity, which can endanger consumers, and not in accordance with government regulations, and the absence of a warning.
9	Dangerous and there are warnings	Very high severity, which can endanger consumers, and not in accordance with government regulations with a warning.
8	Very high	Defective products and not suitable to be used and cause the smooth lines disrupted production

		and caused 100% scrap
7	High	Defective products cause little disturbing smooth production lines, most of the scrap, the rest can be sorted (if it is good / could be rework). Failure causes the customer is not satisfied.
6	Medium	A small percentage of the scrap, the rest do not need to sort (already good) and the customer is not satisfied with the product.
5	Low	The smooth production line a little disturbed, can be 100% product and rework the product must be returned by consumers.
4	Very Low	Most can be rework and the rest was good, the possibility of products returned by consumers.
3	Small	Only a small portion can be rework and the rest was good, and the average customer complaints.
2	Very small	Complaint only provided by certain customers.
1	No	There was no effect nothing

Table 2. Rank Probability of Failure / Occurrence (CEP-ASTRA)

Occurrence (O)		
Rating	Definition	Description
10	Very high: failure almost inevitable.	More than one event per day or more than three occurrences in 10 events
9		One occurrence every three or four days or more than three occurrences in 10 events
8	High: repeated failures.	One event per week or five occurrences in 100 events
7		One event each month or one-time occurrence in 100 events
6	Moderate: The failure is to one-time events	One occurrence every three months or three events in 1000 events
5		One occurrence every six months to one year or one event in 10,000 events
4		One event every year or six occurrences in 100,000 events
3	Low: relatively small failure	One occurrence every one to three years or six occurrences in the ten million events
2		One occurrence every three to five years or two events in one billion events
1	None	One incident more than five years or at least two events in one billion events

Table 3. Rank Detection (CEP-ASTRA)

Detection (D)		
Rating	Definition	Description
10	Absolutely uncertainly	There are no controls to detect the failure mode.
9	Very remote	There are very few controls to detect the failure mode.
8	Remote	There are few controls to detect the failure mode.
7	Very low	There is very low for control to detect failure mode.
6	Low	Have low control to detect the failure mode.
5	Moderate	There are controls to detect the failure mode.
4	Moderately high	There are high control to detect the failure mode.
3	High	High control is to detect the failure mode.
2	Very high	There are very Cleaner control for detecting the failure mode.
1	Almost certain	Full almost certainly be able to detect the failure mode. Control of reliable detection is known as a similar process.

4. Result and Discussion

Table 4.FMEA Overall Process

Failure Mode and Effect Analysis
Item Pulp and Paper Cutting tipe *Sheeter* knives
Model Number/Year
Core Team

No	Process Function	Potential Failure Modes	Potential Effect(s) of Failure	S	Potential Cause(s)/Mechanism(s) of Failure	O	Current Process Controls	D	RPN
1	Making holes with Milling Machine	Flow from furious is not working properly	The diameter of the hole is not in accordance with the size	8	Lack of fluid due to negligence of the operator collant	5	Directing the work by supervisors to the service	3	120
		Not conducted an examination of the drill			A negligent operator does not work in accordance with the applicable procedures	3	Directing the work by supervisors to the service	5	120
		Drill shifted from the center of drilling			Drill vibrations in the workpiece due to the use of drilling methods are not appropriate	8	Playing the piece rate (RPN)	8	512
		Blunt drill			Changes in the	5	Change	2	80

					geometry of the drill		new drill		
2	Making holes with Milling Machine	Placement position of the workpiece is not proper	The distance between the hole diameter not in accordance with the size	7	Less accurate at the time of work / operator fails	6	Granting sanctions warning to the operator	3	126
		Limited manual machine			Difficulties in measuring the distance between holes	8	Use template hole during drilling process	2	112
		Distance measurements are not precise hole			Using markers and measuring ruler	7	Use template hole during drilling process	2	98
3	Hardenning	Workpiece placement positions that are not appropriate	Cracks in the knife cut	8	Failure operator	3	Directing the work to the operator	2	48
		Out of fuel			Failure operator	2	Directing the work to the operator	3	48
		Time and temperature of combustion			The absence of standardized application of employment	3	Application of standardization work	2	48
4	Grinding Surfac	Handling of different machines every shift	Thickness is not in accordance with the specified size	5	There is no standardization of cutting speeds	8	Rework done on the grinding	3	120
		Blade thickness measurement error			One look at Figure / are not careful	6	Rework done on the grinding	2	60
5	Milling Degree	Wear and tear on the grinding stone and the workpiece through friction	The sharpness of the knife cut the sharpness ineligible	4	The temperature monitor is not in accordance with the actual situation	8	Setting the temperature back on the computer	5	160
		different machines every			Work is still based on operator experience	8	Milling process gets Rework	2	64

		shift					degrees		
		Whetstone not suitable to be used			operators did not record the age of disposable millstone	6	Returned / rework gets honed milling degrees to re -	2	48
6	Plotter	Measurement error	The length of the knife is not in accordance with the size	5	Operator negligence because no rigorous in looking at Figure	8	Rework is returned to the plotter to be cut back	1	40
		Operators are not comfortable			The room is hot, no air filter	2	Rework returned plotter	2	20

Table 5. Conventional FMEA Rank

No	Process Function	Potential Failure Modes	Potential Effect(s) of Failure	S	O	D	RPN	Categories	Rank
1	Making holes with Milling Machine	Flow from furious is not working properly	The diameter of the hole is not in accordance with the size	8	5	5	200	L-M	2
		Not conducted an examination of the drill			3	5	120	L	3
		Shift drill			8	8	512	H	1
		Blunt drill			5	2	80	VL-L	4
2	Making holes with Milling Machine	Placement position of the workpiece is not proper	The distance between the hole diameter not in accordance with the size	7	6	3	126	L	3
		Limited manual machine			8	2	112	L	3
		Distance measurements are not precise hole			7	2	98	VL-L	4

3	Hardenning	Workpiece placement positions that are not appropriate	Cracks in the knife cut	8	3	2	48	VL	5
		Out of fuel			2	3	48	VL	5
		Time and temperature of combustion			3	2	48	VL	5
4	Grinding Surface	Handling of different machines every shift	Thickness is not in accordance with the specified size	5	8	3	120	L	3
		Blade thickness measurement error			6	2	60	VL-L	4
5	Milling Degree	Wear and tear on the grinding stone and the workpiece through friction	The sharpness of the knife cut the sharpness ineligible	4	8	5	160	L-M	2
		different machines every shift			8	2	64	VL-L	4
		Whetstone not suitable to be used			6	2	48	VL	5
6	Plotter	Measurement error	The length of the knife is not in accordance	5	8	1	40	VL	5

		Operators are not comfortable	with the size		2	2	20	VL	5

Table 6. Rank categories

Rank	Kategori	Class Interval
9	VL	Jan-49
8	VL-L	50-99
7	L	100-149
6	L-M	150-249
5	M	250-349
4	M-H	350-449
3	H	450-599
2	H-VH	600-799
1	VH	800-1000

From Table 5 can be seen that the results of the output value has a value different, where the highest score on the hole diameter of defect was not in accordance with the size, which is because of the fricative drill happened in the process of making holes on milling machines with score severity, occurrence, and detection, respectively 8, 8, 8 which produces the output value of RPN of 512 with High category, so in this case the high category is ranked first. Continued on next ranking value by category LM, L, and so on.

Having done research on the causes of defects and mode of the most influential of the defects that occur by using the FMEA

method, it can be concluded among other things:

5. CONCLUSION

method, it can be concluded among other things:

1. Defect modes of the most influential is the bit that shifts in production resulting milling machine the size of the hole diameter not in accordance with the specified size.

2. Defect mode can be seen on RPN values from highest to lowest or by looking at the rank that has been matched to existing categories.
3. By looking at the table and niali FMEA RPN who has produced the improvements made from the types of disabilities because of what happened can be priority first.
4. Defect diameter hole was not in accordance with the size due to the use of drilling methods are not appropriate.

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