The Investigation of Plastic Injection Molding Defects of Side Mirror Cover

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***Abstract* - In order to reduce defects of products in the plastic injection by using the Evolution stability improvement. The models which the information was collected are side mirror covers model J02C from the present production line by observation, questionnaire, interview and notes from employees in the department. Analyzing the data by Fish-Bone and 5-Why Analysis define the exact problemswhich cause defects in the injection process. Damages in J02C model come from adjusting KANBAN, Silver Streak and Pit. Assumption to improve the process is adding proper equipments and working procedure in the spinning process and solve the problems that make the wheel deformed, the study found that, the main problem is the oven operated in too high temperature. Comparison of the percentage of wastes revealsthat, the percentage of initial waste is 25.06%, nonetheless after a process improvement, the percentage was reduced to 1.84%, which decreased 23.22% according to the target at 2% after such improvement.**

***Keywords* - Injection Molding Defects, Fish-Bone, 5- Why Analysis, KANBAN, Damage, Deformed.**

I. INTRODUCTION

Murakami Ampas (Thailand) Company Limited (IMCT.) is a supplier and distributor of automobile's side mirror for automotive manufacturers, both domestic and export [1].

Responsibility for injection parts has been arranged by KANBAN and handover them to Quality Control Department. Other responsibilities of the Department are controlling, improving and purchasing the appropriate equipment for the best quality and price which can directly reduce costs of production. Another way to reduce costs is reducing the quantity of defects in Injection Department.

An adjustment in KANBAN, Silver Streak and Pit have apply for developed because these are the main causes of NG part in department. The basic concept is that defects from injection process should not exceed 2% .

The product model J02C induced more defects than other model. The model J02C will be delivered to customers both domestic and export. From observation in the actual working area, found that the production quality is in a good level, but the amount of waste generated is in a medium level. However, the number of wastes can be significantly reduced to an acceptable level, if variables which generate wastes are revealed through data analysing. This can allow a company to be benefited in a long term.

II. METHOD

2.1 Collection of data

Data from an actual condition at present time is collected, in order to examine and analyse numerous problems at one point. In the process of data collection, actual data survey is gathered from certain works of employees, which every procedure of the process or problems has been recorded.

In the aftermath, the data is analyzed through these steps to resolve the problem from the Evolution Stability Improvement Model Dynamic Local Rank Preservation (Dynamic LRP).

2.2 The process of the project

In order to solve the problem, Evolution Stability Improvement Model (Dynamic LRP) suggests severalprocess to resolve the problem in Figure 1. This project was carried out according to the procedure throughout the project [2].

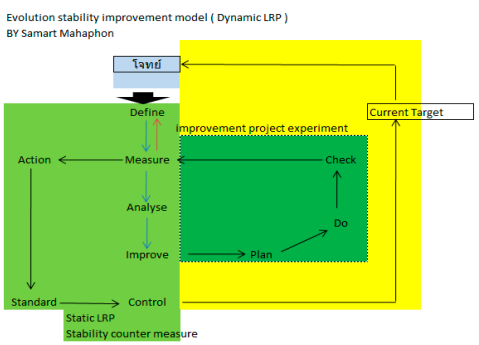

Fig. 1 Evolution Stability Improvement Model (Dynamic LRP)

III. RESULT

3.1 Selection of production sample

From the collection of data on production volumes and the amount of waste generated in the workpiece, three main model's results were significantly higher than others.

TABLE I
The volume of data collected, production schedule and the volume of waste in model 565W, 578W and J02C in June 2015

Model	565W		578W		J02C	
	Total	NG	Total	NG	Total	NG
WK 23	23221	821	42442	2373	30948	6155
WK 24	45998	1561	40830	1730	32702	10888
WK 25	36019	1236	51094	5928	39984	8783
WK 26	41244	2645	47434	4129	21276	5481
Total	146482	6263	181800	14160	124910	31307
%NG	4.28%		7.79%		25.06%	

The model of J02C are generated waste more than others, which is appropriate to be the sample as shown in Table.1.

3.2 Problem

In the process of this selection

Object - To reduce any defects in J02C model
AIMS - Quantity of defect after improvement
Problem - How does the quantity of defect generated will be Decreased.

3.3 Define

To understand the actual production process, every production step of the problem and the cause of defects.

3.4 Measure

Survey of current conditions and processes. Recording data of model J02C in June 2015.

Port Pareto chart from data shows the quantity of defects in J02C model and the use of Pareto's Principle in selected pieces will be an improvement. As in the Figure 2 [3].

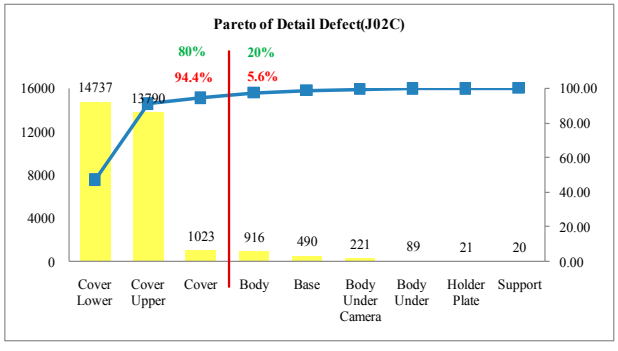

Fig. 2 Pareto Chart of part NG in J02C model

The defect found in Pareto's Principle is Cover Lower, Cover Upper and Cover respectively from Pareto Chart. After the piece of works that need an improvement have been revealed, then analyze the causes of defects. The data about the defects in the piece of work were plotted on Pareto Chart. As in the Figure 3, 4 and 5.

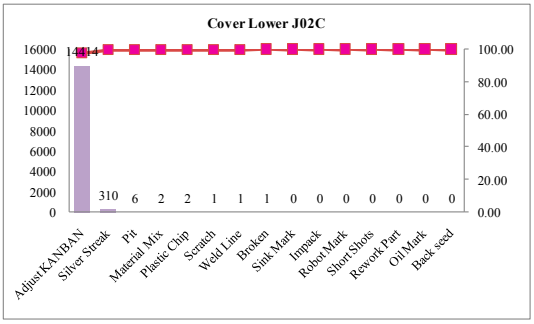

Fig. 3 Show causes and the quantity of defects generated in Cover Lower

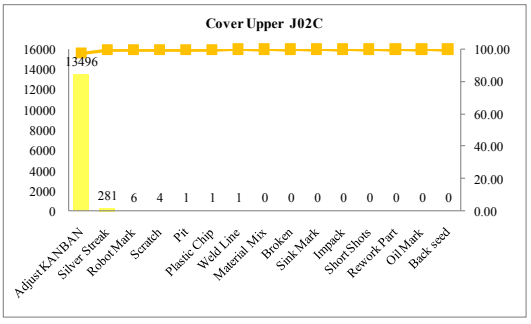

Fig. 4 Show causes and the quantity of defects generated in Cover Upper

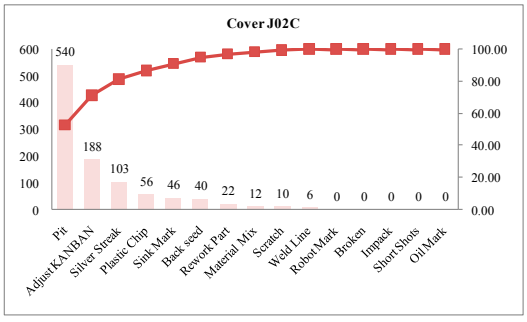

Fig. 5 Show causes and the quantity of defects generated in Cover

Use Fishbone chart to find the cause of the problem Adjust KANBAN , Pit and Silver Streak. As in the Figure 6, 7 and 8.

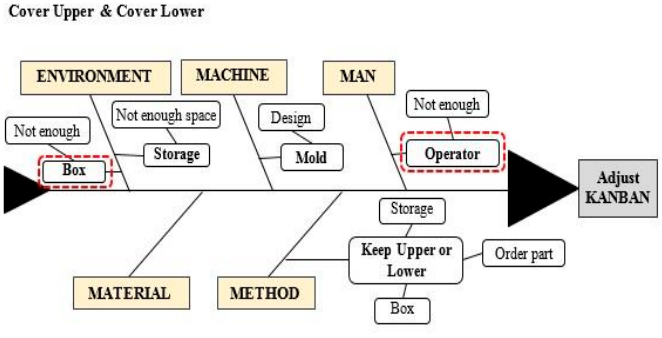

Fig. 6 Define by Fish-Bone (Adjust KANBAN)

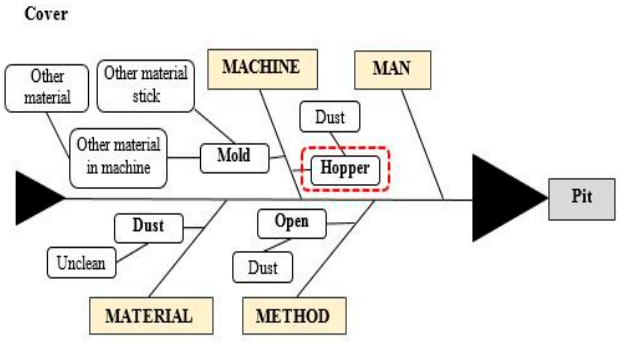

Fig. 7 Defines by Fish-Bone (Pit)

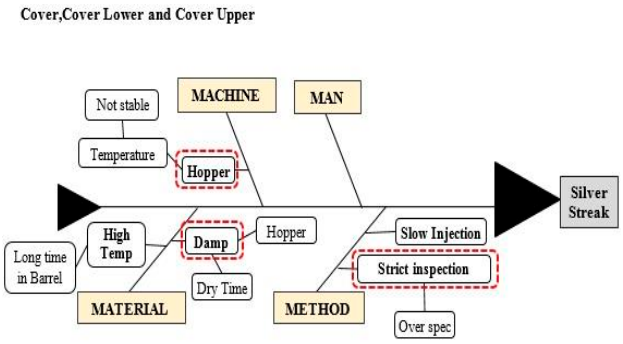

Fig. 8 Defines by Fish-Bone (Silver Streak)

3.5 Analysis

There is a data that will be used in analysis to resolve more problems, including the causes. However, such data cannot indicate a major problem. Therefore, such data should be taken into analysis in order to discover the cause of the problem along with its variables. Therefore, the data must be analyzed according to the following Why Why analysis.

TABLE II
Problems analyzed by Why Why Analysis
Problem: Defect in process

	Problem	Why 1	Why 2	Why 3	Why 4	Root Cause	Recurrence Prevention
Defect	Adjust KANBAN	Choose to keep only one side of the products	Boxs are not enough	No calculation box to fit a production.	There is no department to responsible evident	Box is not enough	Set quantity of box system in accordance with production to each month
			Operators are not keep all products	It makes 4 products for time	Within the same mold	Operators are not keep all products	Add operator
			Order is unequal	Customer demand for the two products of unequal.			
	Pit	Plastic seeds are unclean	Dust contaminated plastic seeds	Open production system Hopper tank have dust		Hopper tank has dust	Clean hopper tank on weekend
	Silver Streak	Plastics are moisture	No plastic baking equipment before machine	No experiment for measure of moisture		Plastic is moisture	- Add small hopper - Measure moisture of plastic seed
		strict inspection	havn't limit sample	No coordinate with QC		strict inspection	Set limit sample

3.6 Improve

The analysis makes known-causes of defect in the production process. The guide lines to an improvement .

Table III
Problem and improvement

Problem	Improvement
Adjust KANBAN	- Set quantity of box system in accordance with production in each month
	- Add operator
Silver Streak	- Install Small Hopper
	- Set moisture standard
	- Measure moisture plastic seed before inject every day
	- Set limit sample
Pit	- Clean hopper tank on weekend

3.6.1 Improvement analysis

Adjust KANBAN system in accordance with the volume of production and additional operator, make a quantity of defects from adjust KANBAN in the Cover Lower which the percentages was reduced from 11.54% to 0.45% and the Cover Upper could reduce from 10.80% to 0.33%.

Silver Streak: Add small, measure moisture, plastic seed before injection and set a limit sample. Then, make a quantity of defects from Silver Streak in the Cover Lower which the percentages were reduced from 0.25% to 0.03%, the Cover Upper was reduced from 0.22% to 0.08% and the Cover could reduce from 0.08% to 0.04%.

Pit : Plan of a cleaning Hopper tank make quantity of defects from Pit in the Cover which the percentages were reduced from 0.43% to 0.02%.

3.6.2 Summary

The analysis found that the additional equipment and process can reduce the quantity of defects. J02C model which the Percentage was reduced from 25.06% to 1.84%. The percentage NG of all part in J02C model before and after improvement as in Figure 9.

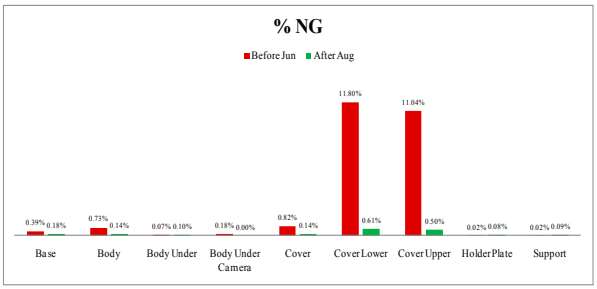

Fig. 9 Graphs about comparison of the percentage
Of defects on each product before and after the improvement.

Holder Plate, Body Under and Support product have a higher percentage. Other product has the percentage of improvement decrease. The percentage of defects on all models equal to 1.84%

3.7 Check

After the improvement, additional equipment and process, percentage of defects is reduced by the targets set in the first place. Nonetheless, the re-checking procedure has to be done in order to confirm by collecting production data since 15 days. To check whether the percentage is less than or equal to 2%.

3.8 Measure

To check with the result in the process of data collection, it can be answered or solved the problem by using the collected data to define the inspection process.

Percentage of defects as 1.72%. According to target set at first place.As in Figure 10.

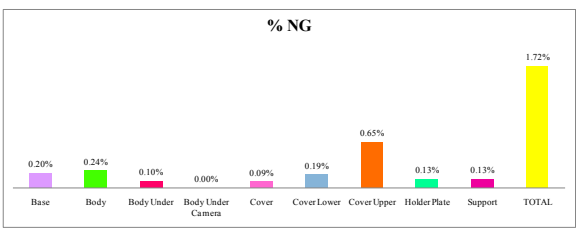

Fig. 10 The percentage of defects in J02C model in the measurement process.

Discussion

- Collection data can be inaccuracy.
- Evolution Stability Improvement Model (Dynamic LRP) can be applied to solve other problems by expanding into other departments of the company in order to reduceproduction costs and escalate the production performances.

IV. CONCLUSIONS

From the study of the problems of the deformation of the products, found that there are pits on the cover of products, adjust KANBAN occurred in the Cover Upper and Cover Lower and Silver Streak on 3 products used for improvement which was analyzed the causes of the problem in the process and was plan to define the solution from summary cause, includes the Evolution Stability Improvement Model (Dynamic LRP). As part of quantity control and collect data of check product.

The Cover has a percentage of Pit 0.43%, reduced to 0.02%. Adjusted KANBAN in the Cover Upper could reduce from 10.80% to 0.33% and the Cover Lower has a percentage of Adjusted KANBAN from 11.54% to 0.45%. Silver Streak in Cover has percentage at 0.08%, reduced to 0.04% from the improvement. In the Cover Upper have 0.22%, reduced to 0.08 % and the Cover Lower has the percentage of defect as 0.25% reduced to 0.03%. Which were summary of J02C model found that after improvement, the percentage of defects have 25.06%, reduced to 1.84% in August 2015.

REFERENCES

[1] Murakami Ampas (Thailand) Company Limited (IMCT.). (2013). *Corporate Information* [Onlline]. Available: http://www.ampas .co.th/corporate.html

[2] S. Mahapoln, *"Evolution Stability Improvement Model (2015Dynamic LRP) Knowledge"*, Isuzu Motors Co.,(Thailand) Ltd, 2013.

[3] A. Vanichchinchai. (2010), *Pareto's Principlepart1and part 2*. [Online]. Available: http://202.183.190.2/FTPiWebAdmin/ knw_ pworld/image_content/85/81-86.pdf

[4] S. Patcharaphan. (2009), *Defect in plastic injection, cuase and guidelinesforsolution*. [Online]. Available:file:///C:/Documents% 20an%20Settings/sutas/My%20Documents/Downloads

[5] Logistics Corner. (2011). *MU-Da (7 WASTES)*. [Online]. Available: http://logisticscorner.com/index.phpoption=com_ content&view=article&id=2706:-7-7wastes&wastes&catid=67: operation management&Item id=93