

## CHAPTER 5

### CONCLUSION AND RECOMMENDATIONS

#### 5.1 Conclusions

This study is aimed determining the proper preventive maintenance policy and designing a maintenance scheduling for the top coat painting machine.

After analyzing the failure data record of the machine, it shows that most machine breakdowns come from failures of soft air valve and purge air valve. Therefore, the valve replacement schedule is selected to be the preventive maintenance policy for the machine. Preventive replacement policy should be employed because it can reduce maintenance cost and improve equipment reliability.

The replacement scheduling for each valve is designed by computing the frequency of valve replacement based on a cost model. The objective is to minimize the annual maintenance cost of the machine by seeking the appropriate time interval of valve replacement. For this, the machine failure data is first analyzed to monitor how they distribute per Weibull's theory. Second, the total maintenance cost is calculated by interesting breakdown and scheduled replacement cost.

Next step, time interval for each valve replacement is calculated by applying mathematical and statistical method to the maintenance cost and history of the machine. Then, we will have the right time interval of valve replacement which yields the minimum annual maintenance cost of the machine.

For the other machine components, we seek for breakdown appearance and breakdown cause to define appropriate maintenance activities for them. After that average time interval of preventive activity is defined based on machine manual and maintenance staffs suggestion.

Finally we can create maintenance scheduling which consisted of plans as following :

1. Main maintenance plan in 5 years
2. Yearly / Monthly maintenance plan

After finishing several plans, next is maintenance controlling to make maintenance more efficient. This controlling can be separated into 2 items :

1. Resources controlling which focuses on maintenance staff, spare parts providing, and maintenance equipment preparation.

2. Data controlling which focus on machine history records by production operators. Production section will duplicate the record and submit to maintenance section daily for further machine history recording. This data will be useful for maintenance plan adjusting in the future.

For the proposed plan of valves replacement, the company can save the annual maintenance costs of a top coat painting machine approximately 10900 baht came from 5796 baht and 5086 baht for soft air valve and purge air valve respectively. This value is not too much but if the company applies the way to create the plan to other top coat painting machines, a large amount of money will be saved because of this study.

To apply the result from this study to the real action, some assumptions should be defined as following :

1. Replacing parts or components makes the machine in its highest performance.
2. The replacement action does not introduce any defects.
3. The time-to-failure distributions are exactly defined.

Sometimes it is difficult to perform the study due to a number of problems, for examples, failure data of some components are

unavailable, maintenance staffs themselves are very busy working their daily duties, etc.

## **5.2 Recommendations**

As previously said, this study should be further continued that I would like to raise some comments that might be useful for the company. The issues are as following :

1. In this study, there is not enough failure data of many components so we use machine manual and staffs interview to assign maintenance activity time interval of top coat painting machine. However, these data should be kept and then the maintenance scheduling yielding the minimum machine maintenance cost can be created.

2. Time interval for replacement is subject to breakdown and schedule replacement costs which are both maintenance costs. Making sensitivity analysis of time interval against these varied costs gives us chances to see how sensitive time interval is to the variation of costs, in other words, how much each cost impact the time interval. Varying cost value yields a range of each particular cost needed to be maintained in order to keep the time interval constant.

3. Correct and useful data will help adjusting and planning maintenance plan more efficient in the next time. Therefore machine operator has to be responsible and pay attention to machine maintenance data recording.

4. In this study, only top coat painting machine is analyzed to design a preventive scheduling. However, the procedure is quite normal, so it can be applied to all machines in the same way. This is necessary if management aims to minimize the total annual maintenance cost of the company.