

**PREVENTIVE MAINTENANCE INTERVAL
OF CORRUGATOR MACHINE
IN PT PURINUSA EKAPERSADA**

FINAL PROJECT

Submitted in order to complete the requirement

Bachelor of Engineering



By :

Sanjaya Purnama Sukma

06 14 05042

**INDUSTRIAL ENGINEERING STUDY PROGRAM
FACULTY OF INDUSTRIAL TECHNOLOGY
ATMA JAYA YOGYAKARTA UNIVERSITY
YOGYAKARTA
2010**

APPROVAL

Thesis of International S-1 Program Entitled:

**PREVENTIVE MAINTENANCE INTERVAL OF CORRUGATOR MACHINE IN PT
PURINUSA EKAPERSADA**

Written by :
Sanjaya Purnama Sukma
(Student's Number : 06 14 05042)

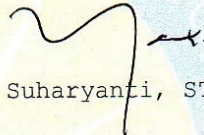
Have been Examined and approved on: December 2010

Adviser,



(S. Setio Wigati, ST., MT.)

Co-Adviser,



(Y. Suharyanti, ST., MT.)

Board of Examiner:
Chairman,



(S. Setio Wigati, ST., MT.)

Member,



(Ag. Gatot Bintoro, ST., MT.)

Member,



(Ir.B. Kristyanto, M.Eng., Ph.D.)

Yogyakarta, December 2010
International Industrial Engineering rogram
Faculty of Industrial Technology
Universitas Atma Jaya Yogyakarta

Dean,



(Ir.B. Kristyanto, M.Eng., Ph.D.)

I dedicate all my memories to



ACKNOWLEDGEMENT

Thank's to The God for His blessings, strength, and guidances that allow the writer to finally finish the Final Project Report, entitled "INTERVAL OF PREVENTIVE MAINTENANCE CORRUGATORS MACHINE IN PT PURINUSA EKAPERSADA".

The Final Project Report is made to fulfill one of the requirements to reach bachelor degree of Industrial Engineering from Atma Jaya Yogyakarta University.

In this moment, the writer would like to thank to all parties who have helped the writer to accomplish the Final Project and report making as mentioned below:

1. Our Lord in Heaven for His blessing, spirit, strength and guidance to finish the final project report
2. Mr. Ir.B. Kristyanto, M.Eng., Ph.D., as Dean of Industrial Engineering Faculty Atma Jaya University
3. Mr. The Jin Ai, ST., MT., D.Eng., as Head of Industrial Engineering Study Program Atma Jaya University
4. Mrs. Ririn Diar Astanti, ST., MT., as Coordinator of International Industrial Engineering Study Program
5. Mrs. S. Setio Wigati, ST., MT., as adviser who has given many advises during final project constructing
6. Mrs. Y. Suharyanti, ST., MT., as co-adviser who has given many advices during final project constructing

7. Mr. Joko Suseno as the production manager of PT Purinusa Ekapersada Semarang for the warm hand shaking which motivate me to do my best
8. Mr. Nanang, Mr. Amin as machine operator who teach me about corrugators
9. My lovely parents that always supports, pray, and believe me to complete my study
10. My families for all the supports and prayers
11. Veronica Yulyanti, who always encouraging while I doubt
12. Lucky Kristantyo who help me in any difficulties.
13. Herfi, Wiwin, Crist, Iswo, Yozi, Widya, Shinto, Rico, and all my best friend that I can not mention one by one
14. Piter, Pandu, Memei, Rio, and Alex; My friends from TIKI 2006 who always support and willing to share a lot of experience together.
15. Other parties who has helped the writer in doing the internship study and report constructing, but unfortunately can not be mentioned one by one.

The writer realizes that the final project report is not the perfect one. So, the writer would like to accept any critics and suggestion from the readers. Hopefully, the final project report will bring a lot of benefits for all parties and the final project report can bring many advantages for the readers. Thank you.

Yogyakarta, 23 November 2010

The writer

CONTENT

Cover	i
Approval	ii
Dedication	iii
Acknowledgement	iv
Content	vi
List of Table	ix
List of Figure	x
List of Attachment	xi
Abstract	xii
 CHAPTER INTRODUCTION.....	 1
1.1. Background	1
1.2. Problem Statement	2
1.3. Research Objectives	2
1.4. Scope	2
1.5. Research Methodology	3
1.6. Outline	4
 CHAPTER 2 LITERATURE REVIEW.....	 6
2.1. Previous Research	6
2.2. Recent Research	7
 CHAPTER 3 THEORY.....	 8
3.1. Maintenance Definition	8
3.2. Types of Maintenance	10
3.2.1. Preventive Maintenance	10
3.2.2. Corrective Maintenance	11
3.2.3. Running Maintenance	11
3.2.4. Predictive Maintenance	11

3.2.5. Breakdown Maintenance	11
3.2.6. Emergency Maintenance	12
3.3. Reliability	12
3.4. Failure Rate	12
3.5. Time to Failure Distribution	15
3.6. Changeover Decision	20
3.7. Optimum Preventive Maintenance	20
CHAPTER 4 COMPANY PROFILE AND DATA	22
4.1. Company Profile	22
4.1.1. History of Company	22
4.1.2. Production System	23
4.1.3. Production Process	24
4.1.4. Maintenance System PT Purinusa Ekapersada	28
4.2. Data	28
4.2.1. Time Repair Data	28
4.2.2. Work Hours Corrugators Machine	28
4.2.3. Opportunity Cost and Defect Cost	32
CHAPTER 5 DATA ANALYSIS AND DISCUSSION	34
5.1. Data Analysis	34
5.1.1. Preliminary Data Analysis	34
5.1.2. Time to Failure and Time Failure.....	34
5.1.3. Time to Failure Distribution	35
5.1.4. Model Formulation	36
5.1.5. Model Validation	43
5.2. Discussion	48

CHAPTER 6 CONCLUSION	50
6.1. Conclusion	50
6.2. Suggestion	50
Reference	51
Attachment	53



LIST OF TABLE

Table 4.1.	Hotplate Downtime Data	28
Table 4.2.	Mechanical Repair Data	30
Tabel 4.3.	Total Production Data	32
Tabel 5.1.	Distribution Selection Based on Arena Input Analyzer Software for Time to Failure	36
Table 5.2.	Total Production Data.....	38
Tabel 5.3.	Minimum Cost Hotplate Manual Calculation	44
Tabel 5.4.	Minimum Cost Mechanical Part Manual Calculation	46
Tabel 5.5.	Comparison Between Maple Result and Simulation of Real Condition	47
Table 5.6.	Sensitivity Analysis Sumary	49
Tabel 5.7.	Data Analysis Result	49

List of Figure

Gambar 1.1.	Flowchart of Research Methodology	3
Gambar 3.1.	The Role Maintenance System to Support Production System.....	8
Gambar 3.2.	Bath up Curve.....	13
Gambar 3.3.	Forms of Failure Rate Distribution.....	14
Gambar 3.4.	Beta Distribution.....	16
Gambar 3.5.	Uniform Distribution.....	16
Gambar 3.6.	Exponential Distribution.....	17
Gambar 3.7.	Gamma Distribution.....	18
Gambar 3.8.	Weibull Distribution.....	18
Gambar 3.9.	Lognormal Distribution.....	19
Gambar 3.10.	One Cycle of Failure.....	21
Gambar 4.1.	Production Process in PT Purinusa Ekapersada.....	26
Gambar 5.1.	Model of 1 cycle failure.....	36
Gambar 5.5.	Cost per Unit Hotplate Part of Corrugator.....	41
Gambar 5.6.	Minimum Cost Graphic Mechanical Part of Corrugator.....	42
Gambar 5.7.	Defect Cost Less than Opportunity Cost.....	48

List of Attachment

Attachment 1	Detail of Maple Software for Hotplate Weibull Distribution
Attachment 2	Detail of Maple Software for Hotplate Weibull Distribution with Numeric Method.....
Attachment 3	Detail of Maple Software for Hotplate Lognormal Distribution with Numeric Method
Attachment 4	Detail of Maple Software for Mechanical Repair Exponential Distribution.....
Attachment 5	Distribution Summaries for Hotplate part with Arena Input Analyzer
Attachment 6	Distribution Summary for Mechanical part with Arena Input Analyzer
Attachment 7	Corrugator Machine

ABSTRACT

PT Purinusa Ekapersada is a packaging product company that is subsidiary of Sinarmas Group Company. Sheets and cardboard boxes are the orders commonly received by this company. Corrugator is the main machine to produce sheet and cardboard boxes. Hotplate part and Mechanical part are the main part of corrugators machine. Applying both corrective maintenance and preventive maintenance creates the high defect cost and opportunity cost. This research is proposed to decide the interval of maintenance based on minimizing cost.

The research is done by the model that uses software *Maple V Release 5 Network Edition* to find the interval of maintenance and *Microsoft Excel* to validate the result of maple software. Interval of maintenance system is used for decide time of maintenance based on cost minimization.

Analysis result shows the interval of maintenance and the cost minimization. The interval for hotplate part is 24 hours with cost Rp 196 and reduces 76.2% from initial cost. The interval for mechanical part is 23 hours with cost Rp 45 and reduces 92.4% from initial cost.