Chapter 4

Analyze problems and causes of breakdown

This chapter is studying about problem and cause of breakdown in the part and collect data for improve maintenance system. By analy-ing data carefully the result is very useful to set up the preventive maintenance system. At first the data would be separated in to groups and it will be a guide for improves the system in the future. The data can be analyzed into three ways;

1. Problem and cause of breakdown in each part of each machine.
2. Detail of each changing part.
3. Mean time between failure (MTBF)

4.1 Problem and cause of breakdown in each part of each machine

This thesis scopes in only milk container 200 c.c. Production line. In this production line is separated in to four types of machine.

The first machine type is double station blow molding machine with triple die head. It have three machines are using in this line there are B 16, B25, and B26.

Second type of the machine is cutting machine in this line is used three units there are C16, C25, and C 26.

The third type is silk screen printing machine. In this process are used four units there are A 2, A 3, A 5, and A 6.

The last one is oven it has four units of oven there are O 2, O 3, O 5, and O 6.

After study the manual of the machine, interview with experts of maintenance section and collecting maintenance data found that the cause and breakdown part in each type of the machine could be separated in to many cases as show in Table 4.1, 4.2, 4.3, and 4.4

unit	Problem	Cause
1. Mold Carriage		o-ring
2. Mold Clamp	Oil leak Carriage not move or Mold not clamp	limit switch break, out of position, dirty valve stuck, solenoid burn relay breakdown
3. Blow pin	Oil leak Blow pin not move	o-ring limit switch break, out of position, dirty valve stuck, solenoid burn relay breakdown
4. Hydraulic flow tube system	Oil leak, tube break	Use high pleasure Oil temperature to high overuse
5. Hydraulic pump	Noisy Oil leak	Low oil level Oil filter damage Oil mix with water Oil to hot Incorrect oil type o-ring lose seal leak
6. Heater & Die head	Burnout Not hot	Heater band not tight to zone surface or dirty Wire cut, plug out Temp. control lose
7. Air breather	Stuck, noisy	Dirty
8. Cuter	Stop Useless	Air cylinder seal leak Knife dirty or chip Limit switch lose Relay lose
9. Relief valve	Stuck Noisy	Dirty Pin bend Solenoid valve burn
10. Oil cooler system	Heat	Dirty
11. Pressure reduce valve	Stuck Noisy	Dirty Pin bend Solenoid valve burn
12. Drive coupling	Break Noisy	Over use Unfit Out of position
13. Main motor	Stop, noisy	Bearing dead
14. Screw gear box	Noisy	Bearing dead Low oil level Hydraulic oil dirty

Table 4.1: Cause and breakdown part of blow molding machine.

The cause and breakdown part in each type of the cutting machine can be separated in to many cases as show in Table 4.2

Part	Problem	Cause
1. Knife	Not sharp	Over use Chip
2. Belt	Sleep	Over use
3. Motor	Noisy	Bering dead

Table 4.2: Cause and breakdown part of cutting machine.

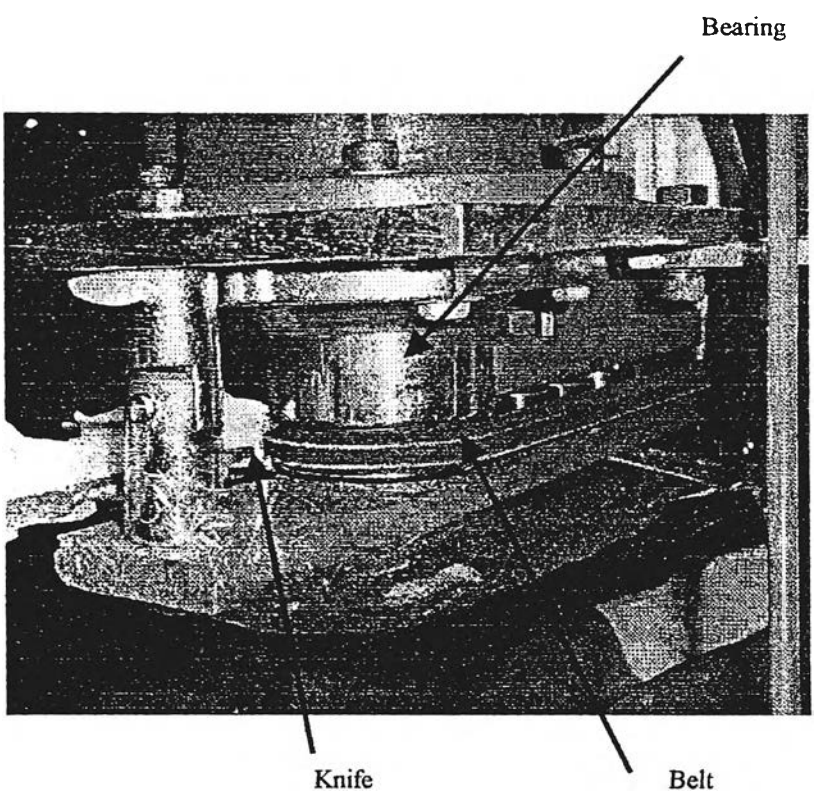


Figure 4.1: Picture of cutting machine

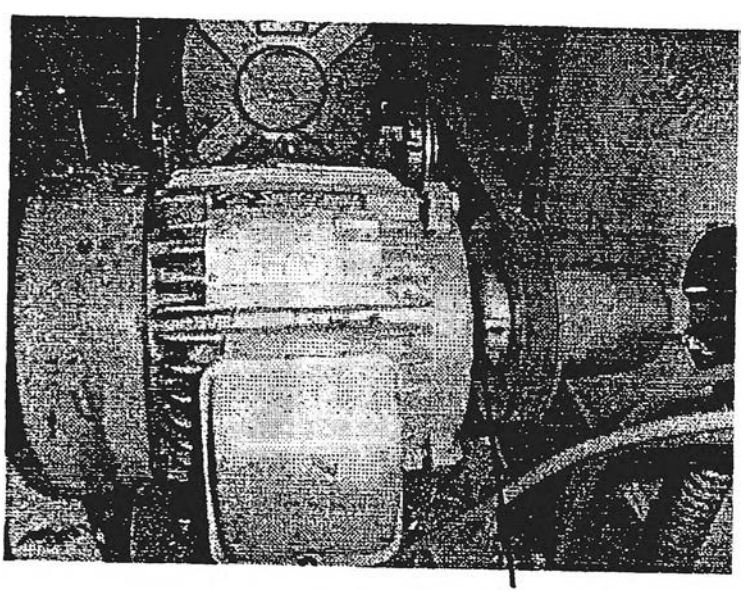
The cause and breakdown part in each type of the silk screen printing machine can be separated in to many cases as show in Table 4.3

Part	Problem	Cause
1. Air filter	Stuck	Dirty
2. Flame treatment system	Not work	Gas or air control valve dirty Limit switch lose or out of position Flame head dirty
3. Motor	noisy	Bearing dead
4. Conveyor	Move slower Stuck, Bend	Overload some ting stuck , baring dead, belt lose Movement System dirty, spring lose
5. Printing set	Squeegee move slower Squeegee stuck	Air cylinder seal leak Limit switch lose or out of position

Table 4.3: Cause and breakdown part of silkscreen-printing machine.

Figure 4.2: Picture of silk screen printing machine

Figure 4.3: Picture of air filter in silk screen printing machine



Motor bearing

Figure 4.4: Picture of motor in silk screen printing machine

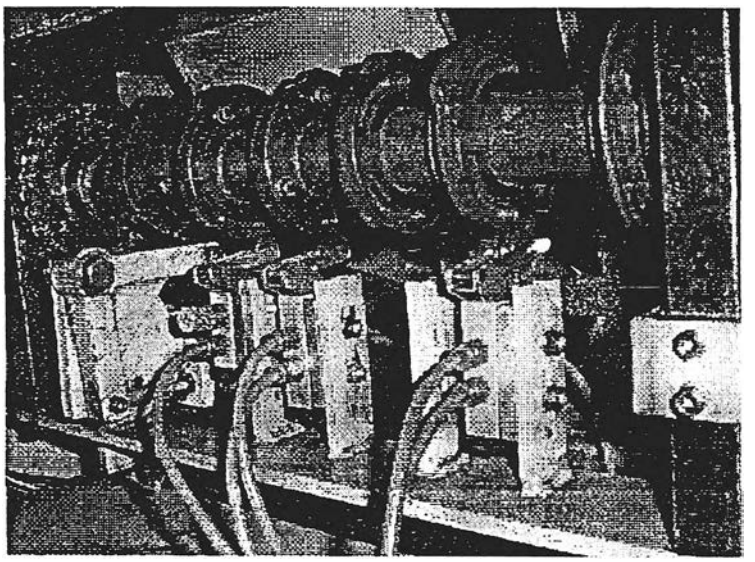


Figure 4.5: Picture of limit switch in silk screen printing machine

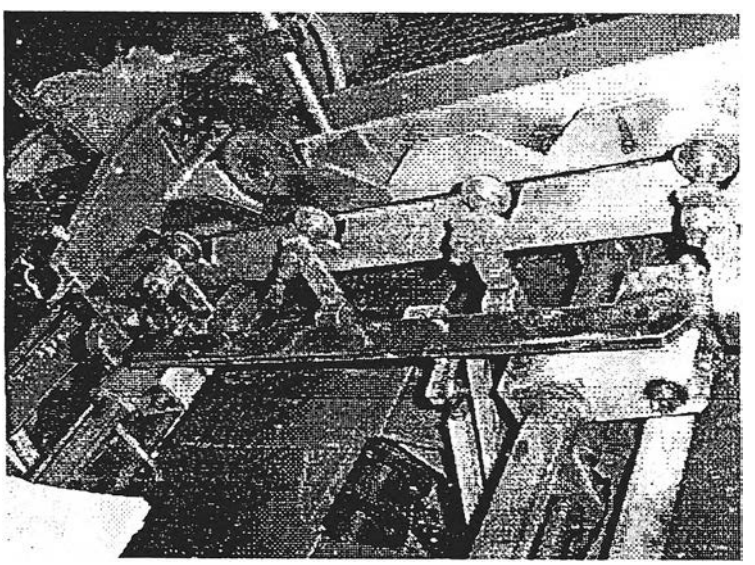


Figure 4.6: Picture of flame treatment system in silk screen printing machine

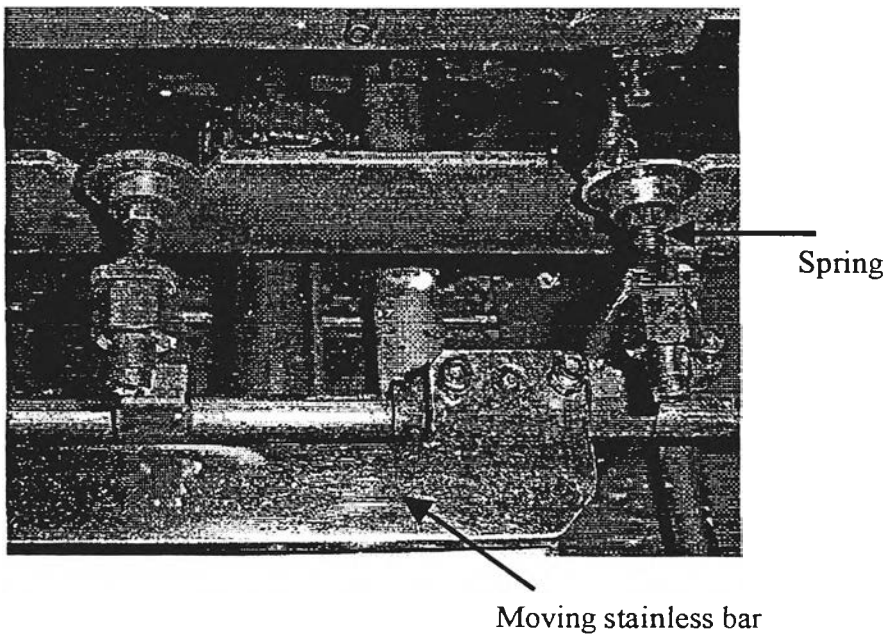


Figure 4.7: Picture of conveyor system in silk screen printing machine

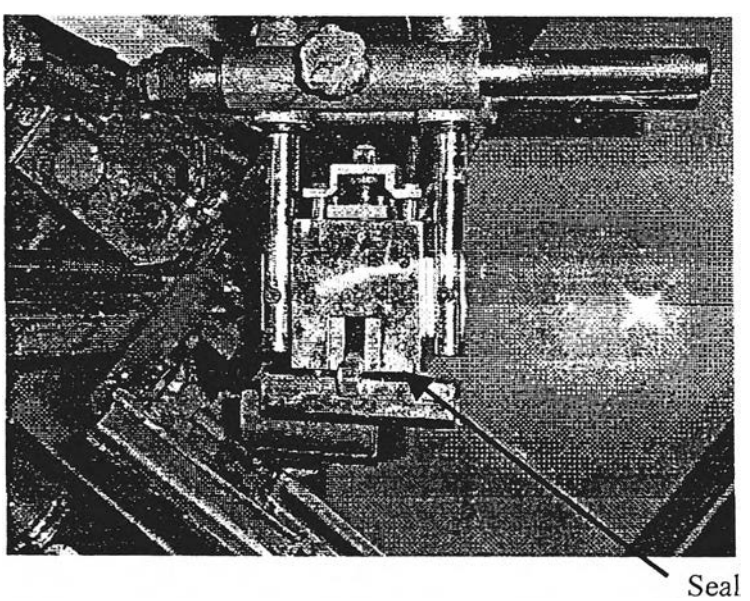


Figure 4.8: Picture of Squeegee system in silk screen printing machine

The cause and breakdown part in each type of the oven can be separated in to many cases as show in Table 4.4

Part	Problem	Cause
1. Conveyor	Chain slips out of gear	Pin joint of chain bend Chain dirty
2. Heater	Not work	Insulator peal out and wire ground Temp. control lose Heater burn
3. Blower	Stop, noisy	Bearing dead Wire cut

Table 4.4: Cause and breakdown part of oven.

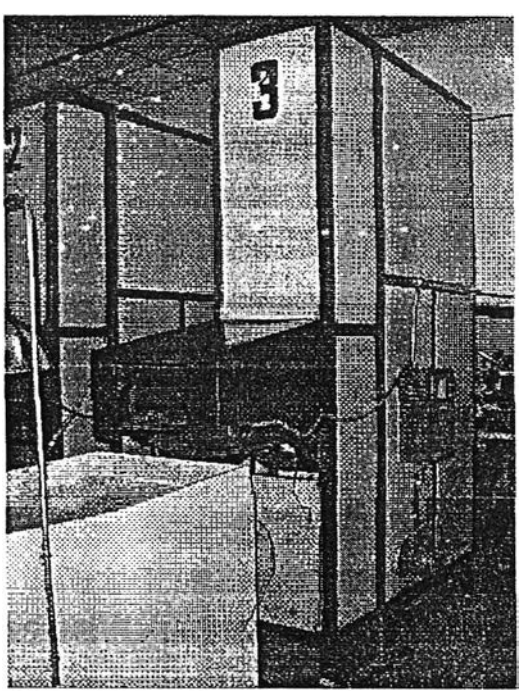


Figure 4.9: Picture of oven

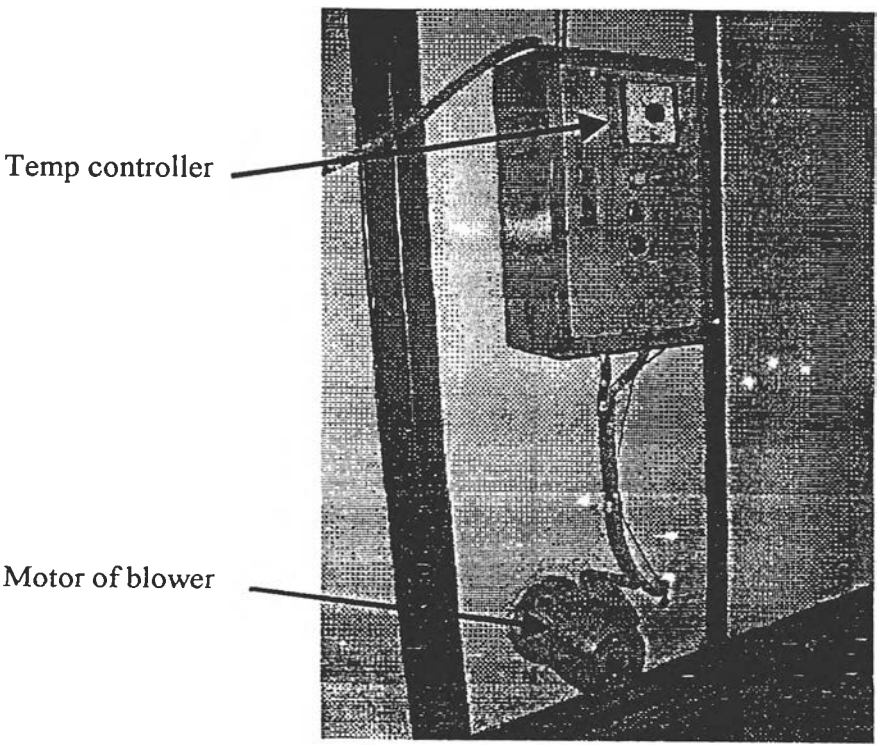


Figure 4.10: Picture of temp controller and motor blower in oven

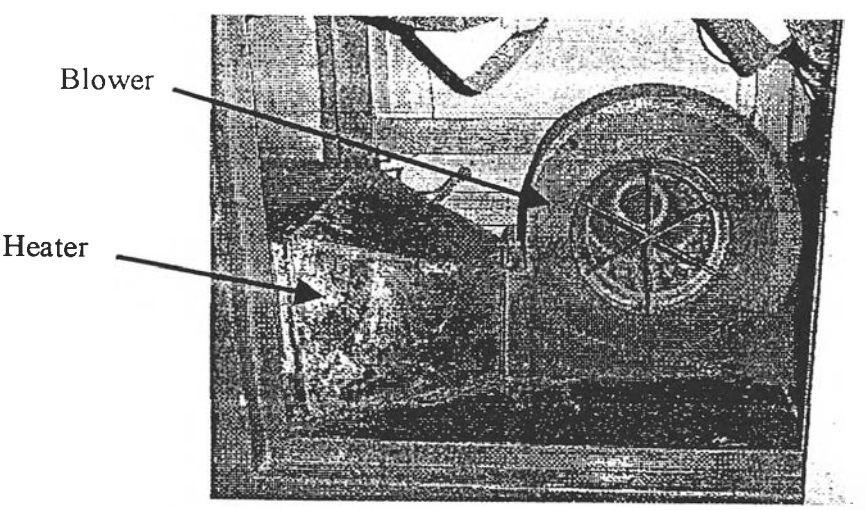


Figure 4.11: Picture of heater and blower in oven

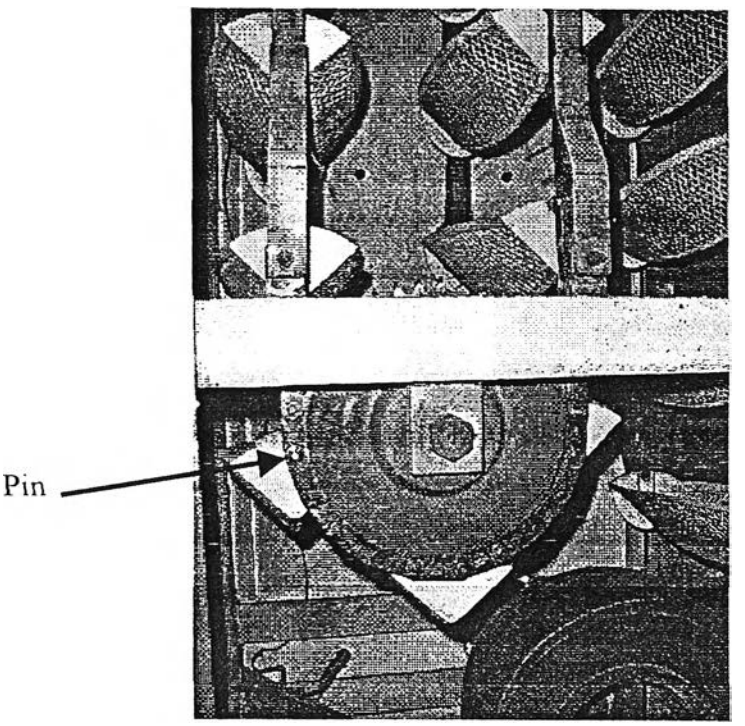


Figure 4.12: Picture of chain and pin in oven

4.2 Detail of each changing part.

From data in topic 4.1 (Problem and cause of breakdown in each part of each machine) it can analyze detail of each changing part that require preventive maintenance plan. The detail of each part is separated in to difference type of the machine. And each type of the machine is composed of many units. In the same time each unit is compost of many parts and each part is working in difference function. The part may use the same type but it works in difference place. The part is assembly with many small parts that different type and size. The first machine that this thesis will show the detail is blow molding machine. The table is separated in to three sections. The first section is grouping the parts that working in the same unit of the machine. Second is the part that working in the same function. And the last one is grouping the small part that assembling in to the function part. For the blow molding machine can separate the unit of machine in to thirteen groups. At the same time in each unit is compost with more than one part. And each part is assembling with many type and size of small part.

The detail that is showing in this chapter is not gathering all of the part of the machine. This thesis is bringing only the parts that have record of break down in three years or some very importance parts. In the same way some parts are not recorded in three years or only one time during three years. And those breaks down part never happen to others machine. For the cutting machine, silk screen printing machine, and oven are used the same concept in order to gathering the date. The blow molding machine may have many detail because it complicate machine and has many function. The machine can product about 7200 shots in one day and one short will get 6 pieces of milk container. Os it can produce more than 40,000 pieces in 24 hours. The second complicate machine is printing machine. It is not much complicate as the first one but quite complicate in printing unit especially in Squeegee part. It can print about 2,500 pieces per hour. The third is oven. The oven is work with printing machine in order to cure color after printed. And the last one is cutting machine. It is not complicate but quite difficult to set the position of the bar and sharp the stainless knife. All detail in each part of each machine is showing in Table 4.5, 4.6, 4.7, and 4.8

The detail of changing part in each unit of blow molding machine is showing in Table 4.5

Unit	Part	Type
1. Mold Carriage	Hydraulic carriage	slider ring seal kw 1000 o-ring 55mmx3mm DAS 50.40/1 Relay LY2 220VAC solenoid valve (220 V) seal 1"x1$\frac{3}{8}$"x$\frac{5}{16}$"
2. Mold Clamp	Hydraulic clamp	o-ring 38mmx1.78mm seal kw 1000 DAS 40.30/1 Relay LY2 220VAC solenoid valve (220 V) seal 1"x1$\frac{3}{8}$"x$\frac{5}{16}$"
3. Blow pin	Hydraulic blow pin	seal kw 1000 o-ring 38mmx1.78mm DAS 40.30/1 Relay LY2 220VAC solenoid valve (220 V) seal 1"x1$\frac{3}{8}$"x$\frac{5}{16}$"
4. Hydraulic flow tube system	Clamp, Carriage, Blow pin Pump out Pump in, Cooling	Hydraulic tube 3/8" Hydraulic tube 1/4"
5. Hydraulic pump	pump	o-ring 150mmx3mm seal 30x43
6. Heater & Die head	Heater band Tempter control Relay	380 V 5000 W 220 V In 3-32V Out 240VAC 25A
7. Flow control system	Flow control valve	Pin stainless ∅ 5mmX21.4mm solenoid valve (220V)
8. Cutter	Air cylinder Cutting system	Air seal 24x32x5 Stainless knife Relay LY2 220VAC Limit switch
9. Relief valve	pin valve solenoid valve	Pin stainless ∅ 5mmX21.4mm solenoid valve (220V)
10. Oil cooler system	Copper tube	½"

11. Pressure reduce system	Pressure reduce valve	Pin stainless ∅ 5mmX21.4mm solenoid valve (220V)
12. Drive coupling	coupling	10 Hp 4"
13. Main motor	bearing	Bearing 6310
14. screw gear box	gear box set	Bearing 32312 Bearing 6309 Bearing 6310 Bearing 6311 Bearing 6312 Oil seal 55mmX75mmX10mm

Table 4.5: Detail parts of blow molding machine.

The detail of the changing part in each unit of cutting machine is showing in Table 4.6.

Unit	Part	Type
1. Cutter	Knife	Stainless still 1.5"x12"
2. Conveyor	Belt	2.5x125 La
3. Motor	Bering	6003

Table 4.6: Detail parts of cutting machine

The detail of the changing part in each unit of silk screen printing machine is showing in Table 4.7

Unit	Part	Type
1. Air filter	filter	½"
2. Flame treatment system	Air control valve system Flame head	Air valve Limit switch 8"
3. Motor	Bearing	6004 2Z
4. Conveyor	Moving stainless bar Motor bearing Spring Belt	∅ 10mmX350mm 6004 2Z 10mm2mm
5. Printing	Squeegee system	Seal 14x22x4 Limit switch

Table 4.7: Detail parts of silkscreen-printing machine.

The detail of the changing part in each unit of oven is showing in Table 4.8

Unit	Part	Type
Conveyor	Chain pin	Pin ∅ 5mmX55mm
Heater	Heater Temperature controller Heat resistance insulator	380ACV 5000Watt E 5 A 220 V 10mm
Blower	Bearing wire	6000 2Z 1x1.5sqmm

Table 4.8: Detail parts of oven.

The causes of breakdown in each type of Blow molding machine are showing in Table 4.9.

Type	Cause of breakdown
1. slider ring 2. DAS 50.40/1	1. Dirty 2. over use
1. seal kw 1000 2. o-ring 55mmx3mm 3. seal 1"x1$\frac{3}{8}$"x$\frac{5}{16}$" 4. o-ring 150mmx3mm 5. seal 30x43 6. Air seal 7. Oil seal 55mmX75mmX10mm	1. Over use 2. hydraulic oil to hot
1. relay 2. solenoid valve (220 V) 3. Tempter control 4. Heater band 5. Limit switch 6. Coupling 4.5"x1.5"	1. Out of position 2. Over use 3. Dirty
1. Hydraulic tube 3/8" 2. Hydraulic tube 1/4"	1. Over use 2. high pressure
1. Pin stainless ∅ 5mmX21.4mm 2. Stainless knife 3. Copper tube 4. Bearing	1. Over use

Table 4.9: Causes of breakdown in each type of Blow molding machine.

The causes of breakdown in each type of cutting machine are showing in Table 4.10.

Type	Cause of breakdown
Knife Stainless still 1.5"x12"	1. out of position 2. over use
Belt 2.5x125 La	1. over use 2. dirty
Bering	1. over use

Table 4.10: Causes of breakdown in each type of cutting machine.

The causes of breakdown in each type of silk screen printing machine are showing in Table 4.11.

Type	Cause of breakdown
1. Filter ½" 2. Flame head 8" 3. Air valve 4. Moving stainless bar ∅ 10mmX350mm 5. Spring 6. Belt	1. dirty 2. over use
1. Limit switch	1. Out of position 2. Over use 3. Dirty
1. Bearing 2. Motor bearing	1. over use
1. Seal	1. Dirty 2. over use 3. high pressure

Table 4.11: Causes of breakdown in each type of silk screen printing machine.

The causes of breakdown in each type of oven are showing in Table 4.12.

Type	Cause of breakdown
1. Chain pin Pin ∅ 5mmX55mm 2. Heater 380ACV 5000Watt 3. Temperature control	1. dirty 2. over use
1. Heat resistance insulator10mm 2. wire	1. over use 2. scratch
1. Bearing	1. over use

Table 4.12: Causes of breakdown in each type of oven.

4.3 Mean time between failure (MTBF)

The data of Mean time between failures is very useful. It can be as a guide in order to set up the preventive maintenance schedule and it can calculate by the formula.

$$\text{MTBF} = \frac{\text{Pr}\,oductive(time)}{No.breakdown}$$

Sample of the record of loss opportunity in waiting for maintenance during July 2001 to December 2001 that rearranged in order to calculate MTBF is showing as follow

Date 2001	Machine No.	Cause
July 1	B25	Relay control mold 2 open breakdown
3	B16	Mold 1 not move limit switch loose
	B25	Clean die head
12	B26	Mold 1 stop cause of limit switch not tie
15	B16	Hydraulic tube mold 1 open leak
	B26	Mold heat clean cooling system
19	B26	Change hydraulic oil
	B26	Clean die head
20	B16	Hydraulic tube open mold 2 leak at night
24	B25	Mold heat clean cooling system
25	B25	Machine heat clean cooling system
26	B16	Hydraulic cylinder mold swing leak
27	B25	Mold movement not smooth
	B16	Motor screw stop because wire short circuit
30	B26	Coil control blow pin breakdown
August 2	B16	Motor burn out
3	B25	Knife system error at night
4	B26	Hydraulic tube open mold leak
7	B25	Change seal of cutting cylinder
8	B16	Hydraulic cylinder blow pin leak
17	B16	Change Pump motor screw
18	B26	Mold heat clean cooling system
24	B16	Hydraulic cylinder blow pin leak at night
	B16	Inverter breakdown at night
28	B16	Heater zone 5,6 breakdown

31	B26 B25	Change air valve Hydraulic cylinder blow pin leak
September 1	B16	Hydraulic tube open mold 1 leak at night
3	B26	Clean die head
4	B26	Change knife
9	B26	Clean pin die
13	B16	Pump motor hydraulic noisy hydraulic oil low level
14	B26	Change knife
16	B25	Change valve control movement system
21	B25	Hydraulic tube open swing leak (mold 2)
23	B26	Heater zone 2 short circuit machine shutdown at night
25	B26	Change coil blow pin
26	B16	Change coil cuter
27	B26	Change coil mold open mold 2
29	B26	Hydraulic cylinder mold swing leak
October 10	B16	Change plug heater zone 5
13	B26	Change blow pin
17	B16	Mold heat clean cooling system
20	B16	Change seal in blow valve
21	B16	Change solenoid release valve
24	B16	Relay control blow pin breakdown at night
November 2	B26	Change coil blow pin mold 1
	B25	Hydraulic cylinder mold open leak (mold 2)
3	B16	Knife break
15	B26	Hydraulic tube open mold (mold 2) leak
16	B16	Knife break and mold heat at night
24	B16	Mold 2 not move relay breakdown
December 7	B16	Heater zone die head breakdown
11	B25	Fix knife
18	B26	Change pin release valve
19	B16	Mold 2 not open control system breakdown
	B26	Change blow valve
23	B16	Clean die head
25	B25	Relay control cutter breakdown

Table 4.13: Sample cause of breakdown in Blow molding machines

Date 2001	Machine No.	Cause
July 9	C26	Change belt
11	C26	Fix control bar at night
17	C25	Fix control bar
25	C25	Motor baring breakdown
August 7	C25	Change knife
10	C26	Control bar bent
15	C16	Change belt
30	C25	Change belt
September 7	C16	fix control bar
17	C25	clean belt & knife
October		
November 13	C26	Change knife
29	C26	Change belt
December 20	C16	Change baring

Table 4.14: Sample cause of breakdown in Cutter machines

Date 2001	Machine No.	Cause
July 3	A 2	Change air &gas tube
26	A 3	Air cylinder breakdown at night
27	A 5	Air cylinder stuck clean the cylinder
August 1	A 3	Change baring conveyor system
15	A 2	Clean Flame system
19	A 6	Change spring of conveyor system
29	A 5	Clean Flame system
September 14	A 3	Change spring of conveyor system
18	A 2	Rack of conveyor system bent
27	A 6	Clean Air cylinder
October 6	A 2	Fix Air cylinder
21	A 3	Change baring motor
November 11	A 2	Air cylinder breakdown at night
14	A 3	Change spring of conveyor system
23	A 5	Belt breakdown at night
December 2	A 6	Change air &gas tube
7	A 5	Change conveyor baring
13	A 3	Belt breakdown
20	A 5	Change spring of conveyor system
28	A 2	Fix Rack of conveyor system

Table 4.15: Sample cause of breakdown in Silk screen machines.

Date 2001	Machine No.	Cause
July 6	O 3	Chain slip out of gear
9	O 2	Chain slip out of gear
10	O 2	Change baring chain gear
19	O 6	Temperature control breakdown
22	O 2	Chain slip out of gear
August 18	O 2	Chain cut off
27	O 3	Heater breakdown at night
September 12	O 3	Chain slip out of gear
24	O 2	Heater short circuit
October 11	O 5	Oven burn
November 4	O 2	Heater stop fuse burn
December 1	O 6	Chain cut off
9	O 5	Heater stop fuse burn

Table 4.16: Sample cause of breakdown in Oven

The Sample of the record of loss opportunity in waiting for maintenance during July 2001 to December 2001 that rearranged in order to calculate MTBF is gathering from the daily report of each maintenance technician. It may miss some data because some time the technician was fixing it but he forgets to record.

The data of Mean time between failures is very useful. It can be used as a guide in order to set up the preventive maintenance schedule. In this thesis use twelve months of data in order to calculate the Mean time between failure values. And the data of productive time in each sampling machine come from production department. It might not be hundred percent correct. The value of productive time in each machine is as follow:

B16 = 439978 min., B25 = 442185 min., B26 = 447692 min.,
C16 = 439958 min., C25 = 440510 min., C26 = 446182 min.,
A2-A3, O2-O3 = 441367 min., A5-A6, O5-O6 = 441283 min.,

The number of working life time in the parts of the blow molding machine that can be calculate by MTBF formula are showing in Table 4.17

Detail of each changing part	MTBF (min.)		
	B16	B25	B26
1. Carriage			
1.1 Hydraulic cylinder			
a) slider ring	439978	442185	447692
b) DAS 50.40/1	439978	442185	447692
c) O-ring 55mmx3mm	219989	221092.5	447692
d) seal kw 1000	219989	221092.5	447692
e) seal 1"x1$\frac{3}{8}$"x$\frac{5}{16}$	219989	221092.5	447692
f) relay	439978	442185	447692
g) solenoid valve	439978	442185	447692
2.Clamping			
2.1 Hydraulic cylinder			
a) DAS 40.30/1	219989	442185	447692
b) seal kw 1000	219989	221092.5	223846
c) O-ring 38mmx1.78mm	219989	221092.5	223846

d) seal 1"x1$\frac{3}{8}$"x$\frac{5}{16}$"	219989	221092.5	223846
e) relay	219989	442185	223846
f) solenoid valve	219989	221092.5	447692
3. Blow pin			
3.1 Hydraulic cylinder			
a) seal kw 1000	219989	221092.5	223846
b) o-ring 38mmx1.78mm	219989	221092.5	223846
c) seal 1"x1$\frac{3}{8}$"x$\frac{5}{16}$"	219989	221092.5	223846
d) DAS 40.30/1	439978	-	-
e) relay	439978	442185	447692
f) solenoid valve	-	442185	-
4. Hydraulic flow tube system			
4.1Clamp (Hydraulic tube 3/8")	439978	221092.5	447692
4.2Carriage (Hydraulic tube 3/8")	-	442185	447692
4.3Blow pin (Hydraulic tube 3/8")	-	-	-
4.4Pump out(Hydraulic tube 3/8")	-	-	-
4.5Pump in (Hydraulic tube 1/4")	-	-	-
4.6Cooling (Hydraulic tube 1/4")	-	-	-
5. Hydraulic pump			
5.1 O-ring 150mmx3mm	-	-	-
5.2 seal 30mmx43mm	-	-	-
6. Heater & Die head			
6.1 Heater band 380V 5000W	-	-	-
6.2 Temp control	-	-	-
6.3 Relay	439978	442185	447692
6.4 die head	-	-	-
7. Flow control valve			
7.1 pin valve (Pin ∅ 5mmX21.4mm)	219989	442185	447692
7.2 solenoid valve (220V)	-	-	-
8. Cuter			

8.1 Air cylinder seal	-	-	-
8.2 Proximity switch	-	-	-
8.3 Stainless knife	10999.45	9826.33	10411.44
8.4 Relay control	-	-	-
9. Relief valve			
9.1 coil of solenoid valve 220V0.2w	439978	442185	447692
10. Oil cooler system	-	-	-
11. Pressure reduce valve			
11.1pinvalve(Pin Ø 5mmX21.4mm)	87995.6	73697.5	89530.4
11.2 solenoid valve (220V)	-	-	-
12. Drive coupling	-	-	-
13. Main motor (Bearing)	-	-	-
14. screw gear box			
14.1 Bearing 32312	-	-	-
14.2 Bearing 6309	-	-	-
14.3 Bearing 6310	-	-	-
14.4 Bearing 6311	-	-	-
14.5 Bearing 6312	-	-	-
14.6 Oil seal 55mmX75mmX10mm	-	-	-

Table 4.17: MTBF of blow molding machine.

The data of working life in the parts of the cutter are showing in Table 4.18

Detail of each changing part	MTBF (hours)		
	C16	C25	C26
1. Knife (Stainless still 2"x12")	8799.16	8637.45	8923.64
2. Belt (2.5x125 La)	36663.16	40046.36	37181.83
3. Motor bearing	-	440510	-

Table 4.18: MTBF of cutting machine.

The data of working life in the parts of silk screen printing machine are showing in Table 4.19.

Detail of each changing part	MTBF (hours)			
	A 2	A 3	A 5	A 6
1. Air filter	-	-	-	-
2. Flame treatment system				
2.1 Flame treatment head (clean)	-	-	-	-
2.2 air valve	-	-	-	-
2.3 Limit switch	-	-	-	-
3. Motor				
3.1 Bearing	-	441367	-	-
4. Conveyor (clean)				
4.1 Moving stainless bar	441367	-	-	-
4.2 Spring	441367	147122.3	220641.5	220641.5
4.3 Bearing	441367	147122.3	220641.5	441283
4.4 Belt	441367	220683.5	220641.5	441283
5. Printing unit				
5.1 Squeegee air cylinder Seal	441367	441367	441283	441283
5.2 Limit switch	441367	441367	441283	441283

Table 4.19: MTBF of silk screen printing machine.

The data of working life in the parts of oven are showing in Table 4.20

Detail of each changing part	MTBF (hours)			
	O 2	O 3	O 5	O 6
1. Conveyor				
1.1 Chain pin (∅ 5mmX55mm)	441367	441367	-	441283
2. Heater				
2.1 Heater (380ACV 5000Watt)	441367	441367	-	-
2.2 Temperature control	441367	441367	-	441283
2.3 Heat resistance sleeve	220683.5	441367	441283	441283
3. Blower				
3.1 Bearing	441367	-	-	-
3.2 wire	-	-	-	-

Table 4.20: MTBF of oven.