CHAPTER 5

PROBLEM IDENTIFICATION

5.1 Existing down time identification.

According to the data of lost time in 1998. The main problem of lost time can be categorized by caused as adjust and inspection time as shown in table 5.1. Pareto chart will be used to select the most severe problem. Data of lost time was collected from January- March'98.

Table5.1 Lost time data from January-March'98

CAUSE	JAN		FEB		MAR	
	TIME (min)	% of total time	TIME (min)	% of total time	TIME (min)	% of total time
A: Set up time	0	0	0	0	0	0
B: Change cutting tool	522	3.3	685	4.3	476	2.57
C: Internal R/M transfer	15	0.1	20	0.1	15	0.5
D: Lubrication	45	0.3	235	1.5	143	0.79
E: Machine breakdown	75	0.5	255	1.6	33	0.18
F I : Inspection	1446	9.1	713	4.5	1301	7.01
Fa : Adjustment	492	3.1	1035	6.5	870	4.69
G: Electrical shutdown	100	0.6	120	0.8	0	0
H:R/M shortage	0	0	25	0.2	85	0.46
I: Quality of R/M	0	0	0	0	0	0

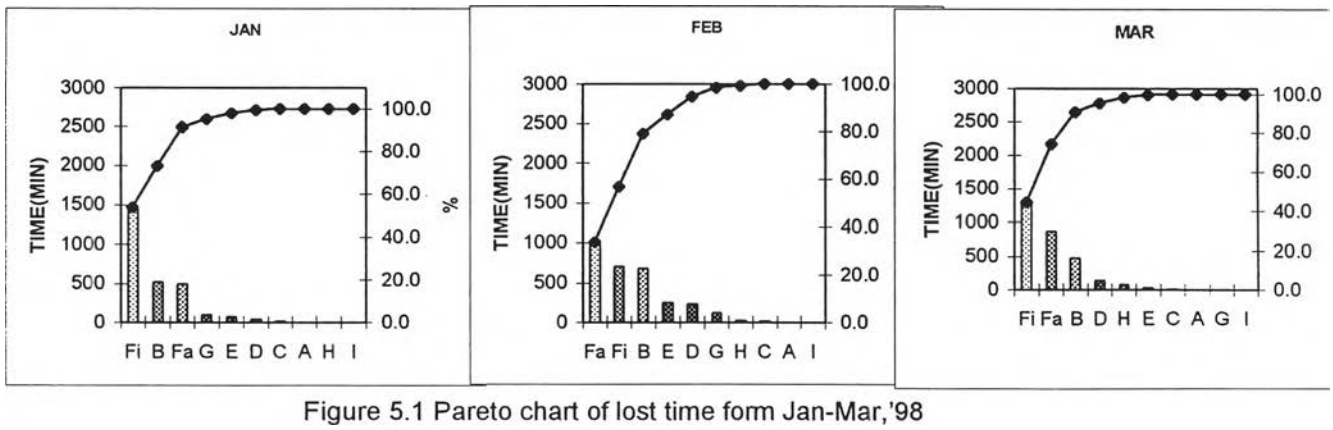

Figure 5.1 Pareto chart of lost time form Jan-Mar,'98

In this information, F adjustment and check were separated into 2 causes, which is inspection cause and adjustment cause.

From graph of lost time in line M05 (table 5.1 and figure5.1), main cause of lost time are Fi inspection, Fa (adjustment) and B (Tool changing). These 3 cause will be improved.

5.2 Inspection losses.

5.2.1 Problem

Inspection time is the highest lost time in machining line. Average losses from inspection time is 6.87% of total working time. Problems of inspection are occurring from the difficulties of measurement usage, the frequency of inspection.

5.2.2 Current situation

Operator of each line was responsible for one inspection in the pilot company. Checking points were established check sheet. Operator will inspect and fill dimension data into a check sheet. Normally, checking frequency was identified by quality control section. It was separated into 3 level, there are 5 times/ shift, 3 times/ shift and 2 times/shift. Checking points for sample line are 35 points as shown in Appendix C. Factors which influence the frequency of inspection is the variety of the manufacturing process which are

1. Variation of tooling and equipment such as tool wear, jig & fixture wear, machine vibration and the leakage of hydraulic or pneumatic clamp.
2. Variation of material, such as, thickness of material, hardness which affect to tooling life and quality of product.
3. Variation from environment, such as, coolant concentration which affect the quality of surface roughness.
4. Variation from operator, such as, working with wrong procedure, skill of operator, fatigue.

The schedule for inspection is shown in table 5.2.

1. Frequency 5-times/ shift will be checked before working time at 8.00 a.m., after break time 10.00 a.m., after lunch 0.45 p.m., after break time 3.00 p.m. and before finish working at 4.30 p.m.
2. Frequency 3 times/shift will be before working time at 8.00 a.m., after lunch 0.45 p.m. and before finish working
3. Frequency 2 times/shift will be before start working and before finish working.

Table 5.2 Schedule for inspection

No. per shift	Time			
	8.00-17.00	7.00-15.50	15.20-23.50	23.20-17.30
2	START, FINISH	⇐	⇐	⇐
3	START,12.40, FINISH	START,11.30 , FINISH	START,18.30 , FINISH	START,24.30 , FINISH
5	START,EVERY BREAKTIME,FINISH	⇐	⇐	⇐
O.T. 2	START, FINISH	⇐	⇐	⇐
3	START, FINISH	⇐	⇐	⇐
5	EVERY 1/2 HR.	⇐	⇐	⇐

Frequency of inspection will be considered from these period and identified in control plan to be the reference in quality system. Criteria for identify frequency are

- Tolerance of dimension and the capable of process,
- Can it effect with the next process?
- Does it effect with performance of product?
- Does it interrupt in the assembly process?

Frequency of checking can be classified according to the dimension in to 3 categories. In case of quality control section, there are

Class A: dimension which affect to the efficiency of product and can't detect in the next operation will be checked 5 PCs/shift.

Class B: same as class A but it can be detected in the next operation. It will be checked 3 PCs/ shift.

Class C: not serious dimension. If this dimension is error, it can be used without affect with product efficiency.

Equipment for inspection composed of vernier, depth vernier, thread gage, special gage, cylinder gage and dial depth gage. Total time for inspection can be concluded as shown in table 5.3. Total inspection time per shift is 58.7 minutes.

Table 5.3 equipment inspection time.

Equipment	Frequency/shift	Time/1frequency (min)	Total inspection time(min)
Vernier	14	0.2	28
Depth vernier	4	0.2	0.8
Thread gage	10	0.2	2
Special gage	16	0.4	6.4
Cylinder gage	40	0.5	20
Dial gage	5	0.3	1.5
		Total time	58.7

5.2.3 Data of inspection time

Lost time of inspection from January to March (Table 5.4) are 1304 minutes/ month or 6.9% of total working time.

Table 5.4 data of inspection time

	JAN	*FEB*	*MAR*
Inspection time (min)	*1446*	*713*	*1301*
Working time(min)	*15959*	*15745*	*18550*
Q'ty	*2369*	*2516*	*2980*
% of working time	*9.1*	*4.5*	*7.01*
Lost time/100 Pcs(min)	*61*	*28*	*43.6*

5.3 Adjustment time

5.3.1 Problem of adjustment

Adjustment will be done when the problems affect to the quality of product or productivity in line. Table 5.5 shows lost time for adjustment in the first 3 months. The cause of adjustment is the quality problem. Manufacturing section identified quality problem in machining line as followed

- Diameter over specification, depth over specification, parallel of surface, perpendicular, circularity, runout, concentricity, pitch circle diameter, screw over specification, damage of drill, tapping, roughness, pitch, radius, setting error, electric problem, machine mistake, forget machine and flaw.

5.3.2 Current situation

Manufacturing staff has solved quality problem in line by using their intelligence based on their existing knowledge, experience and skill. But some problems require a high level of technology or equipment investment and can not be solved without the help of supervisors or management staff.

There are two types of causes, namely,

1. Sporadic causes.
   A single cause of problem which can be easily solved, such as, misoperation, drill breakage, machine breakage. Sporadic causes mainly responsible by line control staff.
2. Chronic causes
   Occurrence of losses is higher than sporadic losses. Chronic losses can not be improved by traditional countermeasures. It is the responsibility of engineer or management.
   In practice, the real important problems are not the sporadic causes, but chronic causes. The problems to be solved were selected by the frequency of occurrence and mean time to solve. The cause of adjustment time in line M05 was shown in table 5.7, which the highest adjustment time is in process M0509.

5.3.3 Data of adjustment time.

From January-March (Table 5.5), the lost time from adjust time was 799 pieces / month or 4.76% on the average of total working time.

Table 5.5 data of adjustment time

	JAN	*FEB*	*MAR*
Lost time (min)	*492*	*1035*	*870*
Working time(min)	*15959*	*15745*	*18550*
Q'ty	*2369*	*2516*	*2980*
% of working time	*3.1*	*6.5*	*4.7*
Time/100 Pcs(min)	*20.8*	*41.1*	*29.2*

From the total adjustment time, cause of problem can be stratified into each process, occurrence and time.

Table 5.7 shows detail of tool, which adjusted in January to March. The longest adjustment time is reamer diameter 15, which take 837 minutes or 34.7% of total adjustment time.

5.4 Tool change time

5.4.1 Problem of tool change

Time for tool change is a part of set up time. Time for tool change was started from tool require to change until the first good product was produced. Eventhough CNC machine provides an easy tool change method but lost time from tool change is still high. Problem of tool change can be separated into 2 categories, frequency of change and time for change.

5.4.2 Current situation.

Tooling for machining center is composed of two main part. There are cutting tools and tool holder. Tooling will be removed from CNC machine spindle and brought to tooling section. Tooling section is responsible for setting new tooling with tool holder. Then leader will take new tool, set at machine and check until a first piece of accepted product was produced. Difference tooling will be set by difference procedures. For example, precision tools such as reamer takes a long time for setting because it need to set run-out of tool as less as possible. Nevertheless, drilling or tapping will take less time because it set height of tooling only.

5.4.3 Data of tool change time.

From January-March, the lost time from tool change time was 3.34% on the average of total working time. As shown in table 5.6

Table 5.6 data of tool change time

	JAN	*FEB*	*MAR*
Lost time (min)	*522*	*685*	*476*
Working time(min)	*15959*	*15745*	*18550*
Q'ty	*2369*	*2516*	*2980*
% of working time	*3.3*	*4.3*	*2.6*
Time/100 Pcs(min)	*22*	*27*	*16*

Table 5.8 shows the lost time in tool change and occurrence of change for each tool. Tool which take longest time for change is reamer diameter 15 in process No. M0508.

Table 5.7 Lost time from adjusting tool in Jan- March 98.

Machine No.	Tool name	Jan		Feb		Mar		Total time (min)	%	Rank	Cause of adjust
		occurrence	Adjusting (MIN)	Occurrence	Adjusting (MIN)	Occurrence	Adjusting (MIN)				
M0502,03	ENDMILL DIA 50	0	0	1	35	3	75	110	4.6	5	Depth of gear room over spec.
	BORING DIA 90	4	143	4	200	2	200	543	22.6	2	Poor surface roughness Diameter smaller than spec.
	CUTTER DIA 53	3	103	3	180	3	210	493	20.6	3	Poor surface roughness
	REAMER DIA 6,11,16.5	0	0	1	55	0	0	55	2.3	7	Diameter smaller than spec.
M050-	COVER CUTTER DIA 18.5	0	0	4	90	3	35	125	5.2	4	Diameter over size
	BURNISHING REAMER DIA 17	1	10	4	60	3	40	110	4.6	5	Surface roughness
M0509	REAMER DIA 15	10	216	11	385	12	230	831	34.7	1	Poor surface roughness Small diameter
	FACE MILL	0	0	0	0	1	40	40	1.7	8	Poor surface roughness
	TAP M6	1	20	1	30	1	40	90	3.7	6	TAP over spec Tool breakage
	TOTAL		492		1035		870	2397	100		

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Table5.8 Analyze cause of tool change

Process	Tool	Month						Total time	%	Rank
		Jan		Feb		Mar				
		Occurrence	Time	Occurrence	Time	Occurrence	Time			
M0501	Drill	1	25	1	30	1	10	65	3.7	7
M0502 /M0503	Endmill dia 50	-	-	3	38	1	25	63	3.6	8
	Boring cutter dia 53	5	78	7	145	-	-	223	12.9	3
	Boring dia 90	3	85	4	172	1	40	297	17.1	2
	Face milling	-	-	4	90	4	45	135	7.8	4
	Drill dia 13	-	-	1	70	-	-	70	4.0	5
	Tap M8	-	-	-	-	1	10	10	0.6	15
	Reamer dia 16.5	-	-	1	28	-	-	28	1.6	13
M0505	Drill dia 9	-	-	-	-	4	50	50	2.9	10
M0507	Reamer dia 17	2	25	2	22	2	20	67	3.9	6
	Reamer dia 18.5	-	-	3	28	2	25	53	3.0	9
	TAP M6	1	10	-	-	1	12	22	1.3	14
M0508	Reamer dia 15	9	255	4	119	6	192	566	32.8	1
	TAP M6	1	25	1	15	-	-	40	2.3	12
	Face milling	-	-	1	10	2	33	43	2.5	11
Total								1732	100	