CHAPTER 3

SAMPLE LINE INFORMATION

3.1 General information of line M05.

1. Product information.

   Product for this line is oil pump case .Raw material is aluminum die casting (ADC12) and cast iron insert (FC20) which made for pressure relief valve inside oil pump case. Figure 3.1 shows the oil pump case which machined by sample line.

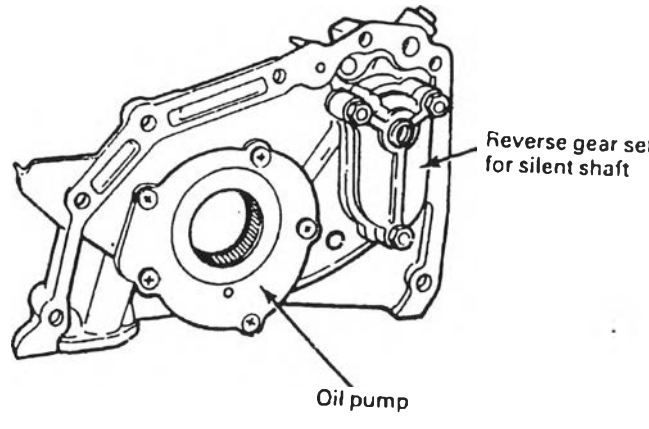

Figure3.1 Oil pump casing.

2. Function.

- Oil pump is used for supplies lubricating oil to all moving parts in the engine. It picks up oil from the oil pan. The pump sends oil through the moving parts.
- Pressure relief valves used for prevent excessive oil pressure.

3. Line layout.

Each machining line composes of 4 areas.

1. Raw material storage area
2. Machine area

There are 12 machine for this line, which perform a different 11 processes. Machines line lay out as show in figure 3.2.

3. Finished goods storage area.

   This area used for keeping stock of after machining product and prepares to transfer to store.

4. Inspection area.

   A table with the instrument is used for checking and collecting data of product. The objective of inspection is to find defect before it occurs by use process control chart. The inspection instrument composed of cylinder gage, venier, special gages and plug gage.

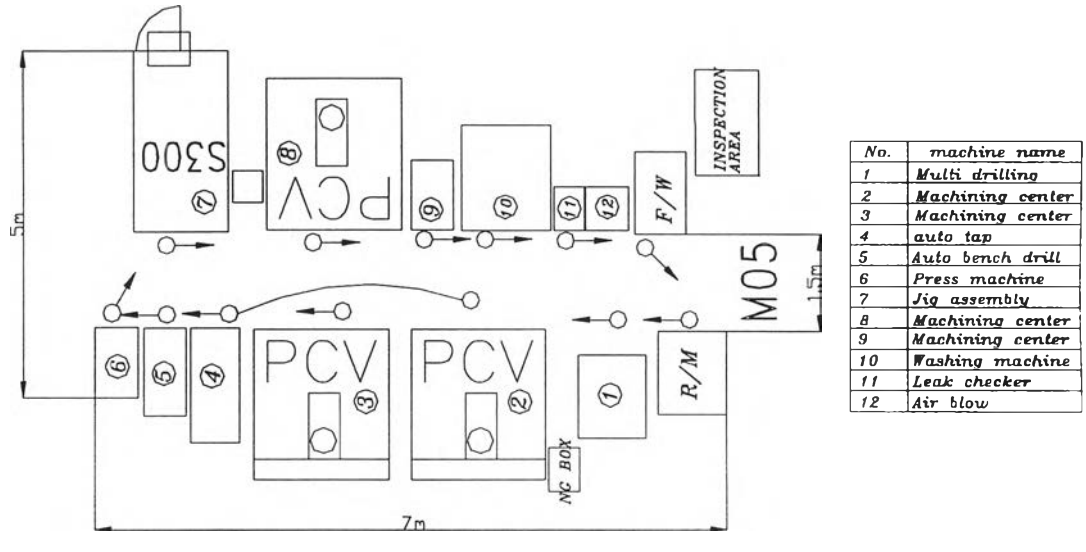

Figure 3.2 Line layout

4. Machine time and manual time.

Table 3.1 Analyze operation time of line M05

No.	*Machine name*	*Machine time (min)*	*Manual time (min)*
1.	*Multi- drilling machine*	*1.36*	*0.1*
2.	*Vertical machining center*	*6.8*	*0.53*
3.	*Vertical machining center*	*6.8*	*0.53*
4.	*Auto tap machine*	*0.26*	*0.3*
5.	*Auto bench drill*	*0.75*	*0.1*
6.	*Press machine*	*0.12*	*0.2*
7.	*Jig for assembly & air tool*	*0*	*0.35*
8.	*2-side machining center*	*3.68*	*0.21*
9.	*Vertical machining center*	*4.3*	*0.25*
10.	*Jig for assembly & air tool*	*0*	*0.37*
11.	*Washing machine*	*2.1*	*0.1*
12.	*Jig for unassembled & air tool*	*0*	*0.17*
13.	*Leak checker*	*1.43*	*0.4*
14.	*Air blow*	*1.6*	*0.4*

Table 3.1 shows the operation time of each line between operator and machine. Machine No.2 and No.3 is doing the same operation. Objective is to reduce cycle time. The longest machine time is machine No.9 (4.3 min)

5. Standard working time per day. Table 3.2 shows standard working time per day

Table 3.2 Standard working time per day.

Shift	*Time*	*Total time(min)*	*Break time(min)*	*Total working time(min)*
1	*8.00 – 17.00*	*540*	*70*	*470*
2	*16.30 – 1.00*	*510*	*70*	*440*
3	*0.00 – 8.30*	*510*	*70*	*440*

6. Standard time for this product is 4.56 minutes per piece.
7. Standard working day per month are 25 days
8. Maximum capacity per shift at 85% = 83 PCs/shift

   Calculation of maximum capacity

   Maximum capacity = $\frac{\text{average working time/ shift X 85\%}}{\text{Standard time per piece}}$

   $= \frac{450 \text{ X}85\%}{4.56} = 83$ PCs / shift
9. Max capacity per day at 85% = 296 PCs/day
10. Total efficiency in January 98 is 67.8 %

    Calculation of total efficiency

    Quantity of product = 2369 pieces

    Total working time = 15969 minutes

    Total efficiency = 4.56 / (15969/2369) X100 = 67.8%
11. Labor productivity = Quantity / man(hour) = 2369/ (15969/ 60)= 8.9 pieces / hour

Actual capacity is lower than maximum capacity because lost time from changing cutting tool, raw material shortage, lubrication, machine breakdown, adjustment, electrical shutdown and quality of raw material.

3.2 Efficiency of line M05.

Average percent of lost time was 18.63 % from January- March '98, and percent of operation time is 81.37%(Figure 3.3). Actual time per piece was 6.4 minutes(Table 3.3) and the standard cycle time was 4.56 minute. It can be concluded that the capacity of production line dropped from 98 pieces. /shift to 70 pieces / shift. Cause of the longer cycle time, working time must be extended to produce more quantity. Figure 3.3 shows the efficiency of line M05 from past data.

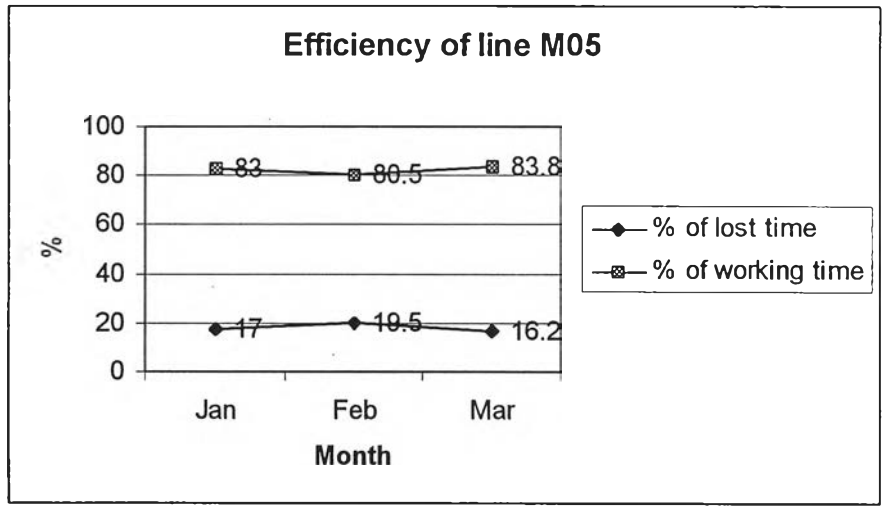

Figure 3.3 Efficiency of line M05 from January-March'98

Table 3.3 Data of actual time from January – March 1998

	JAN	FEB	MAR	Average
Quantity	2369	2516	2980	2621
Working time	15959	15745	18550	16751
Actual time	6.73	6.2	6.2	6.4

3.3 Elimination of lost time.

Refer to item 3.2, the 4 specific losses of sample line can be described as follows

1. Planned down time

   Planned down time for pilot company compose of 10 minutes of morning meeting and 20 minutes of cleaning before finishing of work.

   % of planned down time = planned down time = 30 X100 = 6.6%

   Total working time 450

2. Down time losses

According to the problems in chapter 1 (Figure 1.5) Total working time compose of operation time and loss time. Average first 3 month (January – March) lost time of line M05 was 17.5 % and operation time was 82.44% . Table 3.4 shows the percentage of lost time compare with total working time from January to March.

Table3.4 %Lost time of line M05

	Jan	Feb	Mar
% Lost time	17	19.5	16.2

3.Line balancing losses

Refer to information in chapter 4, cycle time of this product is 4.55 minutes and the manual operation time is 3.48 minutes, which the different time between longest machine time and total manual time is 1.07.

$$\% \text{ of line balancing losses} = \frac{\text{Idle time}}{\text{Cycle time}} = \frac{1.07 \times 100}{4.55} = 23.52\%$$

3. Defect losses

Defect from machining is classified into 21 types. There are non-conforming products from setting error, machining surface not finish cutting, parallel between 2 surfaces higher than specification, damage of drill, depth over specification, tapping NG, roughness NG, perpendicular NG, diameter over specification, circularity NG, run out NG, concentricity NG, pitch circle diameter NG, screw over specification, pitch NG, radius NG, electric problem, machine mistake, forget machine, flaw and disassembly.

Average non-conforming product per month is 46 pieces from 2621 pieces of products.

$$\% \text{ of scrap losses} = \frac{\text{Q'ty of non-conforming product} \times 100}{\text{Quantity of product}} = \frac{46 \times 100}{2621} = 1.7\%$$

- **Conclusion**

<table>
<tr><td colspan="3">Working time (93.4%)</td><td>Planned down time (6.6%)</td></tr>
<tr><td colspan="2">Operation time (82.44%)</td><td>Downtime losses (17.5%)</td><td></td></tr>
<tr><td>Standard operation time (76.48%)</td><td>Line balancing losses (23.52%)</td><td></td><td></td></tr>
<tr><td>Net operation time (98.3%)</td><td>Scrap losses (1.7%)</td><td></td><td></td></tr>
</table>

Figure 3.4 Time chart of line M05

From figure 3.4 the down time losses is 17.5 % of working time, line balancing losses is 23.52% of operation time and scrap losses is 1.7% of net operation time. It can be found that the maximum percent of losses are line-balancing losses and down time losses. These 2 items will be selected to improve.

1. Line balancing losses. It is all operation, which not added value to product. Such as tool change time, approach time, load/unload.
2. Down time losses. It is all losses time because of stop operation time. Data was collected from Daily production report (Figure 1.2).To reduce main operation losses, time of each process will be stratify analyze detail in process. Line balancing losses will be analyzed in next chapter.