CHAPTER 5

IMPROVEMENT PROPOSE

According to the existing problem analysis, the improvement plan was performed for each operation stages in the jacketing process which were (1) Talc bath (2) Pay off (3) Take up (4) Printing unit (5) Water tank (6) Extruder (7) Hopper. The counter action plan, responsibility and due date to finish of each stages were mentional from Table 5.1 to 5.7 respectively.

The summalized status of step operation time was shown in Table 5.8.

5.1 At Talc bath

The corrective action, responsibility and due date to finish for talc bath unit were shown in Table 5.1.

In this unit, valve was removed to near hot jet panel which was more convenience for operators so it should be reduced set up time.

5.2 At Pay off

The corrective action, responsibility and due date to finish for pay off unit were shown in Table 5.2.

To reduce the set up time at pay off unit, the operation of checking quality of conductor was considered to do at the preparation step. Supervisor should prepared tooling box near operation area and trained to operator for conductor joint knowledge to increase skill of operators.

Table 5.1 : Step operation analysis and counter action at Talc bath

Step operation	Operation	Time (min)	Problem	Counter action	Responsibility	Due date
Preparation	Check talc bath condition	-	-	-	-	-
Operation	open air valve for hot jet and pull out conductor	1	take long time because the valve located near floor therefore it is difficult to operate	valve is removed to near hot jet panel	Supervisor	1 month Sep.2,97

Table 5.2 : Step operation analysis and counter action at Pay-off

Step Operation	Operation	Time (min)	Problem	Counter action	Responsibiliity	Due date
Operation	Check quality of conductor	6	take long time due to many checking points	do it at preparation step	Sub operators	2 weeks Aug.13,97
Operation	conductor cut and set bobbin	3	take long time due to no tooling at operation area	prepare tooling box near operation area	Supervisor	2 weeks Aug.13,97
Operation	Conductor joint	2	take long time due to no skill	Training and make skill to operator	Supervisor	2 weeks Aug.13,97
Operation	conductor pull out and pass line	-	take long time due to wire breakage	Improve drawing process and wire stranding process.	Engineers	1year Sep.99
Operation	Pull out conductor	5	-	-	-	-

5.3 At Take up

The corrective action, responsibility and due date to finish for take up unit were shown in Table 5.3.

There were considered to do preparation bobbins, checking product and input data in check sheet in external production line. Morever to make shorter set up time at take up unit, supervisor needed to prepare calculator in production area.

5.4 At Water tank

The corrective action, responsibility and due date to finish for water tank unit were shown in Table 5.4.

Supervisor was advised to reduce set up time at water tank by installation stainless steel plate for operators to take sample from tank easier, training operators to utilize stripper to peel jacket when checking centering in stead of cutter due to more convenience to do and no danger and installation more guide roller to hold cable when pass it in water tank.

5.5 At Printing unit

The corrective action, responsibility and due date to finish for printing unit were shown in Table 5.5.

The main idea to reduce set up time at printing unit was to remove the old set of printing unit and install new set of printing unit instead of it. After that clean the printing unit at external production line before set new printing unit and set ink viscosity for next lot. By this idea, it could reduce set up time at printing unit for all operation except take off old printing unit and set new one.

In addition ultrasonic cleaning machine was utilized to use for cleaning the parts of printing unit such as printing roller, blade holder and shaft roller because this machine had the effort to clean very fast, machine could clean the small gap and operators did not waste the time to clean it

At the adjusting operation, printing roller speed and machine speed was connected automation interlock in order to reduce adjustment time so printing roller speed and machine speed could automatically control.

5.6 At Extruder

The corrective action, responsibility and due date to finish for extruder unit were shown in Table 5.6.

The method to reduce set up time at extruder was done by preparing tool box in production area, using impact wrench instead of normal wrench to take off bolt & nut and remove air gun keeping area.

Moreover the clean shot cleaning machine was utilized to clean die, nipple and breaker plate because it could taken off the sticky compound on those parts. Die, nipple and breaker plate were prepared the spare. When set up operation at extruder unit, operators did not waste their time to clean die, nipple and breaker plate, they should used the spare one. During machine running, they should used clean-shot cleaning machine to clean.

5.7 At hopper

The corrective action, responsibility and due date to finish for hopper unit were shown in Table 5.7.

Modifying hopper was done to reduce set up time at hopper. The modification was removed the out let valve to near hopper tank so operators were easier to take out compound

Table 5.3 : Step operation analysis and counter action at Take-up

Step operation	Operation	Time (min)	Problem	Counter action	Responsibility	Due date
Operation	Prepare bobbin	1	take time	do it at preparation step	Sub operators	2 weeks Aug.13,97
Operation	check sample	6	take long time due to many points to check	sample check should do after completed product changed	Main operator	2 weeks Aug.13,97
Operation	fill data in check sheet	8	take long time due to many data need to fill in check sheet	data should be filled in check sheet after completed product changed	Sub operator	2 weeks Aug.13,97
Operation	calculation data	2	take long time due to no calculator near production area	prepare calculator in production area	Supervisor	2 weeks Aug.10,97
Adjustment	Adjust conductor	2	-	-	-	-
Operation	Pull out conductor	1	-	-	-	-

Table 5.4 : Step operation analysis and counter action at Water-tank

Step operation	Operation	Time (min)	Problem	Counter action	Responsibility	Due date
Operation	take sample from tank	2	take long time due to difficult to do and need skill operator	install stainless steel plate on the water tank in order to make it easy.	Supervisor	3 weeks Aug.21,97
Operation	peel jacket from lead wire	3	take long time due todifficult to do by cutter	utilize stripper instead of cutter	Main operator	1 month Aug.28,97
Adjustment	pass line cord	-	take long time due to need to adjust twist cord	install more guide rollers to hold cable	Engineer	2 weeks Aug.11,97

Table 5.5 : Step operation analysis and counter action at Printing unit

Step operation	Operation	Time (min)	Problem	Counter action	Responsibility	Due date
Operation	take off printing unit	1	take long time due to difficult to lock and adjust by hexagon wrench	modify fixing bolt, do not use hexagon wrench.	Engineer	Aug.28,97
Operation	clean washing plate	1	take long time	do it at preparation step	Sub operator	2 weeks Aug.13,97
Operation	clean printing roll	1	take long time due to difficulty	Make work bench and dipping bath for roll and roll is cleaned during operation by Ultrasonic cleaning machine	Engineer and sub operator	2 month Sep.28,97

Table 5.5 : Step operation analysis and counter action at Printing unit (cont)

Step operation	Operation	Time (min)	Problem	Counter action	Responsibility	Due date
Operation	clean roll shaft	1	take long time due to difficulty	make work bench and dipping bath for roll and roll is cleaned during operation by Ultrasonic cleaning machine.	Engineer and sub operator	2 month Aug.28,97
Operation	clean doctor blade holder	1	take long time due to difficulty	prepare spare and do it at preparation step	Sub operator	1month Aug.28,97
Operation	change ink	7	take long time due to cleaning ink pot is difficulty.	Prepare spare ink pot and do it at preparation step	Supervisor	1 month Aug.28,97
Operation	setting printing unit	2	take long time due to blade holder design is not good	modify blade holder to easier to set	Engineer	1 month Aug.28,97

Table 5.5 : Step operation analysis and counter action at Printing unit (cont)

Step operation	Operation	Time (min)	Problem	Counter action	Responsibility	Due date
Operation	set printing unit	2	take long time due to difficult to lock and adjust by hexagon wrench	modify fixing bolt, do not use hexagon wrench.	Engineer	1 month Aug.28,97
Adjustment	adjust roller speed to be same as machine speed	6	take long time due to difficult	connect automation interlock between machine and roller speed automatically, no need to adjust.	Engineer	2 month Sep.30,97

Table 5.6 : Step operation analysis and counter action at Extruder

Step operation	Operation	Time (min)	Problem	Counter action	Responsibility	Due date
Preparation	set extruder temperature	-	no instruction to set so it is up to operator skill	make instruction sheet for extruder temperature setting	Engineer	1month Aug.28,97
Operation	take out bond heater from cross head	1	take long time due to difficult to turn the screw	change screw to one touch type	Engineer	1 month Aug.28,97
Operation	take out bolt and nut from cross head	2	take long time due to tool keeping panel is too far	make tool box in production area	Supervisor	2 weeks Aug.13,97
Operation	take out bolt and nut from cross head	2	take long time	utilize impact wrench	Engineer	1 month Sep.2,97
Operation	take out nipple holder	1	take long time	utilize impact wrench	Engineer	1 month Sep.2,97
Operation	take out master core	2	take long time	utilize impact wrench	Engineer	1 month Sep.2,97

Table 5.6 : Step operation analysis and counter action at Extruder (cont)

Step operation	Operation	Time (min)	Problem	Counter action	Responsibility	Due date
Operation	cramp of sub extruder open and close	1	take long time	utilize impact wrench	Engineer	1 month Sep.2.97
Operation	cleaning breaker plate, die and nippple	4	take long time	prepare spare and do it at preparation step by cleaning equipment	Engineer Supervisor Sub operator	1 month Sep.2,97
Operation	cleaning cross head and master core	2	take long time due to inconvenience to use air gun because its keeping place is too high	air gun keeping place is moved to 1m high	Engineer	Aug.12,97
Operation	cleaning master core	-	take long time due to many compound burn remaining in master core cause from master core worn out	change new master core	Engineer	2 month Sep.31,97

Table 5.6 : Step operation analysis and counter action at Extruder (cont)

Step operation	Operation	Time (min)	Problem	Counter action	Responsibility	Due date
Operation	set die and nipple	-	take long time due to die and nipple no good quality made wire breakage	1)set incoming inspection and periodically inspection of die and nipple to keep the good condition	Engineer	2 weeks Aug15,97
Operation	set die and nipple	-	take long time due to die and nipple no good quality made wire breakage	improve cleaning method by using cleaning equipment.	Engineer Supervisor Sub operator	2 weeks Aug15,97
Operation	overflow compound	-	take long time due to air bubble problem cause from screw worn out	change new screw	Engineer	2 month Sep.31,97
Operation	overflow compound	-	take long time due to contamination cause from breaker plate worn out	change new breaker plate	Engineer	2 month Sep.31,97
Adjustment	adjust center	21	take long time	utilize double head and job sharing between main operator and sub operator	Engineer	1 month Aug,30,97
Operation	pull out conductor	7	-	-	-	-

Table 5.7 : Step operation analysis and counter action at Hopper

Step operation	Operation	Time (min)	Problem	Counter action	Responsibility	Due date
Operation	check compound	2	take long time due to many item to check	do it at preparation step	Sub operator	2 weeks Aug.13,97
Operation	Cleaning	3	take long time due to difficulty to do	modify hopper	Engineer	7 weeks Sep.21,97
Adjustment	check compound overflow	-	overflow compound had many air bubbles due to screw worn out and fish-eye problem due to breaker plate worn out	change screw and breaker plate	Engineer	2 month Sep.28,97

From the Table 5.1 to 5.7, status of step operation time could be summalized as Table 5.8.

5.8 Improvement Methods

The detail of all improvement were concluded as belows.

5.8.1 Improving method of work

The method to set up the machine had been improved for more conveniences and faster operated are performed as followings.

1. Using impact wrench instead of handy wrench
2. Using ultrasonic cleaning m/c to clean printing device instead of manual cleaning.
3. Using cleaning equipment to clean die and nipple instead of manual cleaning.
4. Connecting automation interlock between machine and roller speed automatically.
5. Changing screw to one touch type at extruder.
6. Installing stainless steel plate on the water tank to more easier to take sample.
7. Using stripper to peel jacket from lead wire instead of cutter.
8. Making a tank by stainless steel and install solenoid valve to control solvent supply unit instead of pumping system.
9. Setting up printing roller by magnet instead of tape
10. Utilizing double head to adjust center

5.8.2 Rearranging the works

The works which were non-productive to do during machine operated were rearranged by separating the preparation step and arranging the operations of main operator and sub operator.

1. The preparation step had been separated from the operation step. Sub operator should be done during the machine working. The preparation operation was shown in Table 5.9.

2. After separated the preparation step, Operations of main operator and sub operator had been arranged as in Table 5.10

5.8.3 Relocating jig and tooling

The jig and tooling had been relocated for more convenience near to work place as followings.

1. Moving air valve to near hot jet panel.
2. Preparing jig and tool box at production area near cross head.
3. Preparing calculator for every table kept check sheet
4. Specific area for printing unit components cleaning near printing unit.
5. Reducing height of air gun keeping area about 50 cm.

5.8.3 Changing new parts

The machine maintenance had been done by changing new parts which were (1) extruder screw, (2) breaker plate, (3) master core.

5.8.4 Preparing spare parts

Spare parts system had been set and some spare parts had been prepared before set up as which were (1) Ink pot, (2) Doctor blade , (3) Side blade, (4) Blade holder, (5) Breaker plate, (6) Die and (7) Nipple.

5.8.5 Making operation standard of work

The operation standard which were set up for training operators were the cleaning operation standard, die and nipple inspection and the procedure of machine set up operations.

Table 5.8 : Summalized status of step operation time before improvement

M/C Stage	Step Operation							
	Main Operation				Sub Operation			
	Preparation	Operation	Adjustment	Total	Preparation	Operation	Adjustment	Total
Pay-off	0	5	0	5	0	11	0	11
Talc bath	0	1	0	1	0	0	0	0
Take up	0	1	0	1	0	17	2	19
Water tank	0	5	0	5	0	0	0	0
Printing unit	0	0	0	0	0	16	6	22
Extruder	0	24	21	45	0	0	0	0
Hopper	0	0	0	0	0	5	0	5
Total	0	36	21	57	0	48	9	57

Table 5.9 : Preparation operation

No	Item	Step
1	Process Operation Manual	Check product name and item no.
2	Conductor	Check conductor diameter and no. of conductor
3	Compound	Check compound name and keep into hopper
4	Dies	Check diameter and appearance
5	Nipple	Check diameter and appearance
6	Breaker plate	Check appearance, clean and insert screen mesh
7	Breaker plate for sub-extruder	Check appearance, clean and insert screen mesh
8	Printing roll	Clean and check appearance and printing code
9	Doctor holder	Set doctor holder to doctor blade
10	Printing unit	Check ink tray, ink color and color concentration
11	Bobbins	Check quality and quantity of bobbins

Table 5.10 : Operations of main operator and sub operation

Step	Main-operator	Sub-operator
1	Take out die, die holder, nipple, nipple holder, breaker plate and set die, die holder, nipple, nipple holder and breaker plate.	Set printing unit Change take up bobbin
2	-Change pay-off bobbins and joint conductor -Pull out conductor	-Hopper cleaning and put compound into hopper Counter setting -Pull out conductor
3	Start and adjust center	Check product centering
4	Speed up and adjust center	Check product centering and change take up bobbin