

CHAPTER VII

CONCLUSION AND RECOMMENDATION

7.1 Improvement Result and Conclusion

7.1.1 Overall Improvement Results

By applying the Six sigma concept for improving percent contamination at the backend line and also for increasing percent of First Yield at autogrammer operation of Cheetah 18 product. The result shows obviously that the manufacturing line loading capacity has been increased from 9.9 KDGR to 11.0 KDRG as illustrated in Table 7.1. This number is also calculated by based on 21 working hour per day, 72.22% cumulative yield and 90% utilization.

7.1.2 Spot Cleaning Operation Result

According to the analysis results, the major variables that cause the contamination problem are Unclear specification, Spot clean operator effectiveness and Air velocity from Laminar

The specification clarification has been set among trainers, technicians, operators and engineers by making it to be one standard which requires zero particles on HGA and allows only 10% of parts can be shipped out with four particles.

The automated P- chart has been implemented to Spot cleaning and FOI operation in order to monitor the operator effectiveness and also provide fast feed back to concerned operations such as Head load and Incoming slider.

The new motors, which the velocity is about 110 ft/min, have been ordered for replacing the currently used. Facility group has responded for this purchasing.

As a result of improvements, the Spot cleaning UPH has been improved from 165 to 188, so, the capacity has been increasing from 9,895 units/day to 12,671 units/day. The percent fast rework of contamination at backend line, including both G1 and G2, has been reduced from 44% to be less than 1%. Additionally, the time study has been re-performed at this operation which is illustrated in Table 7.2

7.1.3 Autogrammer Operation Results

According to the analysis results, the major variables that cause the low first yield at autogrammer are FOS bond epoxy application, Tail tacking, Incoming suspension preload and Adjustment window limits

The new method of FOS bond epoxy application has been trained to operators, trainers, technicians and engineers by applying only 1 drop of needle tip and smear to 75% of FOS bond fixture hole. The visual aid is also provided at this operation.

The changes or elimination of Tail tacking operation is not allowed due to the design constraint. So, about 0.2g of HGA preload has been increased after passing this operation.

The raw suspension preload has been decreased about 0.15g base on the regression equation. This is done at vendor level, so, Cheetah 18 product, an incoming preload is equal to 2.65 ± 0.05 g.

The window adjustment limits has been changed form ± 0.05 to be ± 0.12 g base on the frontline process variation reduction, the preload window adjustment evaluation and correlation between HGA and HSA preload result. After implemented, we have seen that DPMO has been reduced from 700,000 to 180,000.

As a result of improvements, the number of autogrammer can be reduced from 4 to 3 testers and the UPH has been improved from 159 to 230, so, the capacity has

been improved from 12,063 to 13,041 units/day. Moreover, due to one autogrammer has been eliminated, the line spacing has been increased about 80 cm. Therefore, we have seen the opportunity to add one more operator to Tail tacking operation which it causes the capacity increasing from 10,093 units/day to 15,139 units/day.

Additionally, the time study has been re-performed at this operation which is illustrated in Table 7.3

7.1.4 Actual Cheetah 18 Input/ Output, after improvement (Appendix C)

The actual Cheetah 18 Input and Output, after improvement, have been passive from the database which it is illustrated in Table 7.1. The Output is calculated by basing on 72.22% cumulative yield. Moreover, Table 7.4 shows the comparison of Input and Output between after and before improvement.

- An actual loading capacity by cell by day can be calculated as below:

$$\begin{aligned}
 \text{Average Loading by cell/ day} &= \frac{\text{Total Loading}}{\text{Total working day} \times \text{Number of cells}} \\
 &= \frac{728,544}{6 \times 11} \\
 &= 11,039 \text{ HGAs by cell/ day}
 \end{aligned}$$

- An actual output by cell by day can be calculated as below:

$$\begin{aligned}
 \text{Average Output by cell/day} &= \frac{\text{Total Output}}{\text{Total working day} \times \text{Number of cells}} \\
 &= \frac{526,154}{6 \times 11} \\
 &= 7,972 \text{ HGAs by cell/day}
 \end{aligned}$$

7.2 Recommendations

Base on the new line balancing, it has an opportunity to increase the line loading from 11 KDGR to be 12 KDGR. The bottleneck operations are Gimbal bond operation, Flex bond operation, Flex lead bond operation and Head Setter operation.

Gimbal bond operation, there is high opportunity to be a semi-automated. One prototype is still developed and expected to get through production line on the next year.

Flex bond operation, this operation can be eliminated by doing Flex bond before process which can be called as “ Flex On Suspension Assembly or FSA”. The FSA will provided the vendor and in the future products will change them changed to.

Lead bond operation, this operation will turn to be an automated by changing from the normal lead bond to be the automated ball bond. This changing will be totally completed on the middle of next year.

Head setter operation, this operation has high opportunity to eliminate and currently, it has been taken as one of Black belt project.

OPERATION	% SAMPLIN	% YIELD	Revised					Returned Unit
			11 K					
			UPH	H/C	Capacity	Space Requirement		
MRB SCREEN							60	
PRETRIM	100.00%	100.00%	662	1	12512	70	70	
LOAD HEAD	100.00%	100.00%	340	2	12852	70	140	
GIMBAL BOND	100.00%	100.00%	195	3	11057	70	210	
FLEX BOND	100.00%	100.00%	204	3	11567	75	225	
FLEX LEAD BOND	100.00%	100.00%	195	3	11057	80	240	
SERVILANCE # 1 (Sampling)	25.00%	100.00%	160	1	3024	60	60	
SPC BOND PULL	3.53%	100.00%						
COAT LEAD	100.00%	100.00%	372	2	14062	60	120	
TAIL TACKING	100.00%	100.00%	257	3	15139	60	180	
THERMAL OVEN							366	
UNLOAD HGA FROM JIT TOOL	100.00%	100.00%	382	2	14440	70	140	
LOAD IAT TEST ARM	111.17%	100.00%	372	2	14062	70	140	
SERVILANCE # 2 (Sampling)	25.00%	100.00%	160	1	3024	60	60	
SPOT CLEANING	112.17%	100.00%	188	4	14219	60	240	12.17%
HEAD SETTER	100.00%	100.00%	585	1	11057	60	60	
PRELOAD	112.17%	100.00%	230	3	13041	60	240	
STATIC ATTITUDE ADJUST	112.17%	100.00%	225	3	12758	110	330	
REMOVE PRE-SHUNT	100.00%	100.00%	870	1	16443	70	70	
MRE	100.00%	96.00%	281	3	15933	110	330	
ELECTRICAL TESTER	100.00%	72.92%	95.0	6.1	11000			1.00%
FLY TESTER	100.00%	100.00%		0.13				
SPC ALIGNMENT		100.00%		0				
SPC GIMBAL BOND		100.00%		0				
AUTO SHUNT WIRE	100.00%	100.00%	437	1	8259	75	75	
FLAPPER	50.00%	100.00%	250	1	4725	60	60	
UNLOAD TEST ARM	111.17%	100.00%	327	2	12361	75	150	
FINAL INSPECTION	118.57%	99.00%	128	4	9677	70	280	1.00%
QC	10.00%	100.00%	128	1	2419	60	60	
PACK	100.00%	100.00%	1500	1	28350	100	100	
SPC				1				
MH				2				
LEAD GIRL				1				
TOTAL HEAD COUNT				58.54				
HEAD COUNT IN LINE				49				

Space Requirement	
Front line Space available	
Space Requirement front line	1305
Back line Space available	2721
Back line Space Requirement	2701
Total space requirement	4006
Space available	20

Table 7.1 New Manufacturing Line Loading Capacity (11.0 KDGR)

ELEM. NO	ELEMENT	FREQ	NORMAL TIME			REMARK
			ELEMENT	%	UNIT	
1	PICK UP TEST ARM TRAY	5	2.65	100%	0.53	F2
2	OPEN COVER OF TEST ARM TRAY	5	1.80	100%	0.36	
3	PICK UP TEST ARM TRAY	1	1.00	100%	1.00	
4	PUSH FOS ON TEST ARM PIN	1	2.40	100%	2.40	
5	INSPECTION SLIDER	1	4.10	100%	4.10	
6	LOAD TEST ARM TO SPOT CLEAN FIXTURE	1	1.20	100%	1.20	
7	CLEAN SLIDER	1	6.40	65%	4.16	
8	UNLOAD TEST ARM TO TRAY	1	1.35	100%	1.35	
9	CLOSE COVER OF TEST ARM TRAY	5	1.80	100%	0.36	
10	SENT TEST ARM TRAY TO NXT OPERATION	5	2.30	100%	0.46	
11	KEY DATA IN DNP	5	1.80	100%	0.36	

SUMMARIZED TIME	16.28
STANDARD TIME (W/ 15% ALLOWANCE)	2.87
HOUR PER UNIT	0.0053
UPH	188.0
CAPACITY PER OPERATION	3552.5

Table 7.2 New Spot cleaning elements

ELEMENT	QTY.	%	STANDARD TEST TIME	SUMMATION TIME	AVERAGE TEST TIME
LOAD TEST ARM TO TRAY			2	2	2
TOTAL IN	19446				
NOT BEND	11704	60.19%	6.6	6.60	3.97
BEND1	6866	35.31%	14	14.00	4.94
BEND2	825	4.24%	21.8	21.80	0.92
BEND3	42	0.22%	29.60	29.60	0.06
BEND4	5	0.03%	35.70	35.70	0.01
BEND5	2	0.01%	41.8	41.80	0.00
BEND6	1	0.01%	47.90	47.90	0.00
BEND7	1	0.01%	53.90	53.90	0.00
BEND8	0	0.00%	59.9	59.90	0.00
BEND9	0	0.00%	65.9	65.90	0.00
UNLOAD TEST ARM TO TRAY			2	2.00	2.00
TOTAL	19446	1	SUMATION TIME	13.92	
			STANDARD TIME(ALLOWAN	15.644	
			HOUR PER UNIT	0.0043	
			UPH	230.1	
			CAPACITY PER OPERATIO	4349	

Table 7.3 New Autogrammer elements

Production Report

Cheetah18 Product

Number of Cells = 11

	Sat		Sun		Mon		Tue		Wed	
	Target	Actual	Target	Actual	Target	Actual	Target	Actual	Target	Actual
Input	119,900	123,773	0	0	119,900	122,196	119,900	121,802	119,900	123,640
Output	86,592	89,389	0	0	86,592	88,250	86,592	87,965	86,592	89,293

	Thu		Fri		WTD	
	Target	Actual	Target	Actual	Target	Actual
Input	116,267	120,617	119,900	116,516	715,767	728,544
Output	83,968	87,110	86,592	84,148	516,927	526,154

Table 7.4 Summary of Cheetah 18 product daily input/output (After improvement)

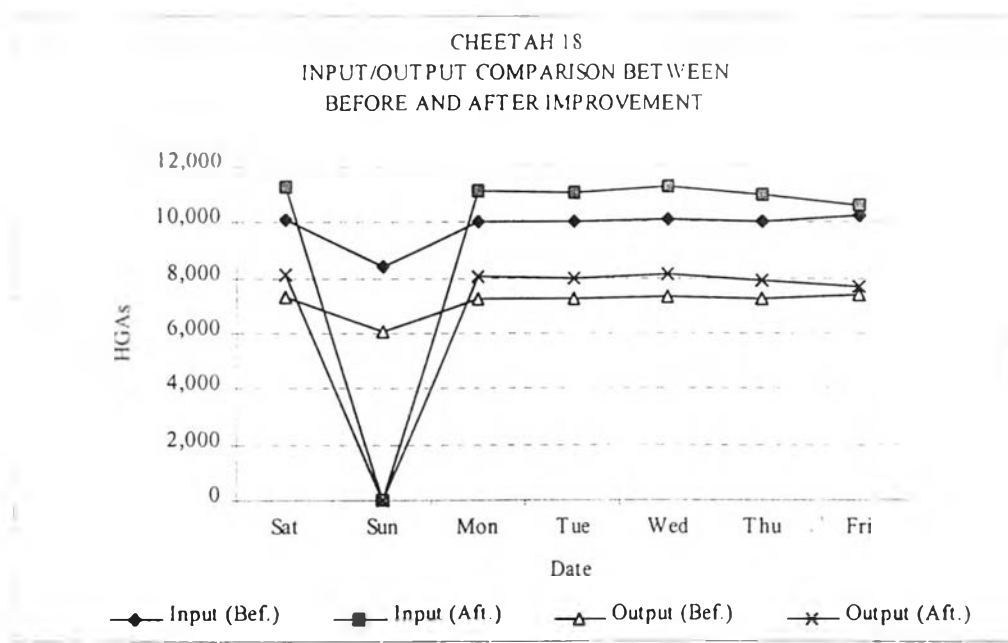


Figure 7.1 Cheetah 18 Input/ Output comparison after improvement