CHAPTER IV

FLEX BOBD OPERATION IMPROVEMENT

4.1 Introduction [1]

4.1.1 Purpose

This process is to bond the FOS (Flex on Suspension) to the suspension (Flexure) using Hysol LD227 adhesive.

4.1.2 Process Control

1) Grounded ESD wrist band must be worn at all times.

2) Contamination control measures specified in Engineering Specifications. This includes:

- Operation to be done in controlled environment.
- Cleanroom gloves to be worn on both hands at all times.
- Cleanroom garments to be worn at all times.

3) Pre-clean work station & equipment.

[1] Flex Bond Manufacturing Process Document.

4) Hysol LD227:

- Adhesive to be stored at -40° F or colder.
- Pot life of adhesive = approximately 2 hours (when thawed). *And*, do not use adhesive which has become stiff, stringy, difficult to dispense, etc.

4.2 Work Instruction [1]

4.2.1 Pre-Operation

1) Inspect the FOS flipper. This is done by placing a JIT tool into the flipper, locking it in position with the locking cam, rotating the flipper in a counter-clockwise motion, and checking the alignment of the tooling hole pin on the JIT tool pin to the flipper pin. If the pins do not line up the flex will not fall on the tool properly. If the pins do not line up contact a technician.

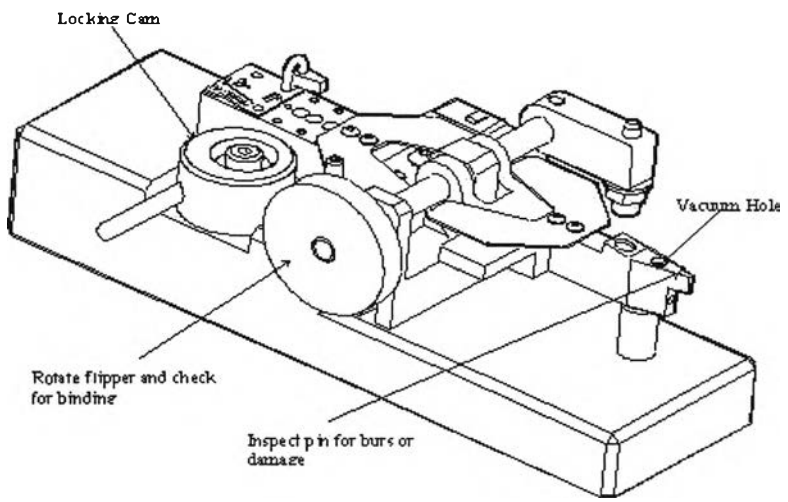

Figure 4.1 JIT Tool loaded into fixture.

[1] Flex Bond Manufacturing Process Document.

2) If the flipper is hard to rotate contact a technician to have it cleaned.

3) Inspect the vacuum tweezers to insure that the stainless steel tip does not extend beyond the end of the rubber tip. If any stainless steel extends below the rubber tip, damage will occur to the spring while loading. The operator can use UV adhesive to secure the rubber tip in the proper location and may also trim the flange for better visibility while loading.

4) Inspect the rubber tip under 30X for signs of contamination. Replace tips with any non-removable contamination or when rubber is missing from the end.

5) Failure to meet any of the criteria is cause not to build any parts.

4.2.2 Post-Operation

1) Obtain the correct flex for bonding.

2) Turn Pie wedge U-clamp out from load arm of suspension.

3) Load JIT tool into flipper. Lock the JIT tool with the locking cam as shown in figure4.2

PUSH JIT TOOL AGAINST FLIPPER

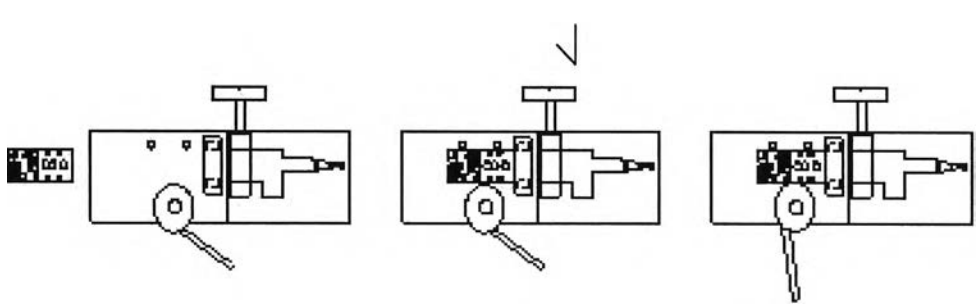

Figure 4.2 The steps of loading JIT tool into flipper.

4) Load Flex onto Flipper Fixture

4.1) Open the tray of flex. The letters on the flex should be backwards.

4.2) Using the vacuum tweezers only, pick up a flex and place it onto the flipper. Do not use fingers to manipulate the flex into position on the flipper.

5) Apply the adhesive to the correct flex locations.

5.1) Dot 1 should be located between the tooling hole and the gimbal widow. Apply a dot of adhesive approximately 10 mils in diameter.

5.2) Dot 2 should be located on the flex over the vacuum hole in the FOS flipper fixture. Apply a dot of adhesive approximately 75% the diameter of the vacuum hole.

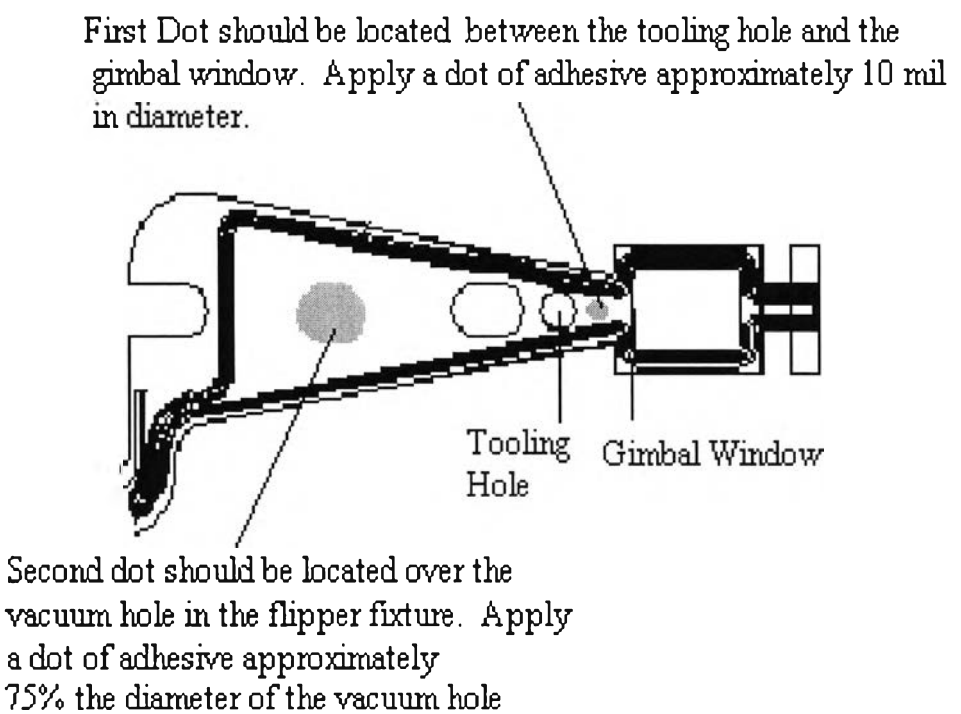

Figure4.3 How to apply adhesive on FOS.

6) Rotate the flipper counter-clockwise and release vacuum on the part, allowing the flex to fall onto the alignment pins of the tool. Then rotate flipper clockwise to start position as shown in Figure 4.4.

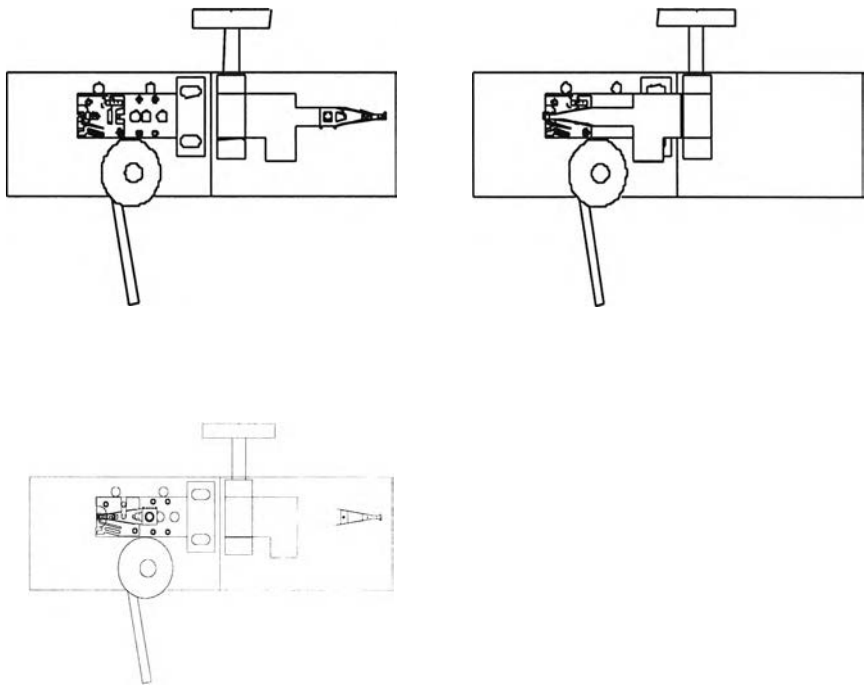

Figure4.4 The steps of flipping FOS to Flexure.

7) Using a pin vise and J-hook (NO fingers) place the Pie wedge U-Clamp/Flex Clamp onto the flexure. The correct placement of the Pie wedge U-Clamp/Flex Clamp is aligned over the alignment pins on the JIT tool.

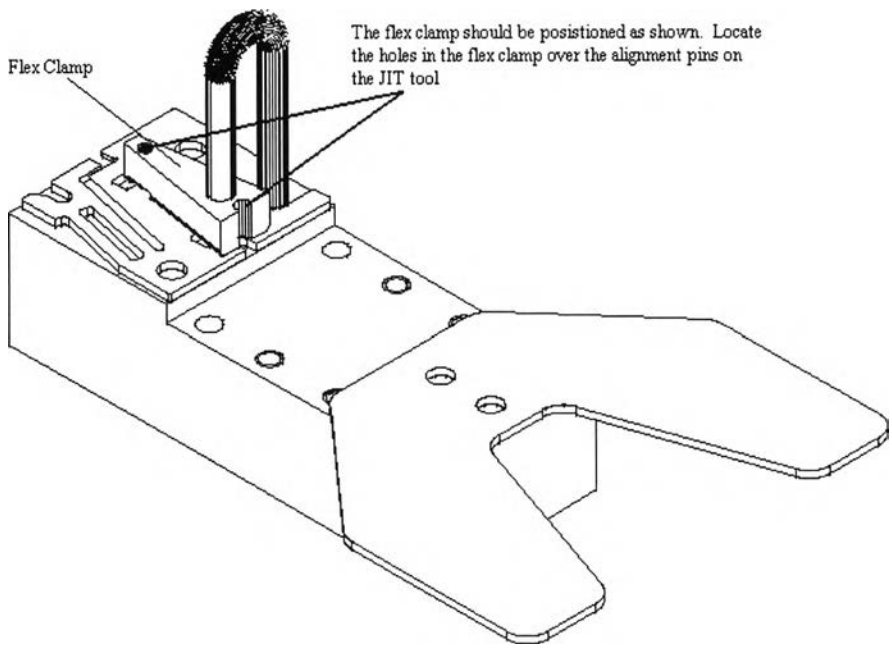

Figure 4.5 JIT Tool and its Pie wedge U-Clamp location.

8) Release the cam, remove the JIT tool and place the tool into the carrier tray.

4.3 Motion and Time Study

Work elements at Flex bond or FOS bond operation are performed very similarly to Gimbal bond operation. Their difference is used material. Gimbal bond is to bond flexure to slider sitting on JIT Tool but flex bond is to bond FOS to flexure sitting on JIT Tool. Therefore, standard time, that are used for some elements, are often referred to each others. One more difference between both operations is FOS bond has to turn out Pie wedge pushing flexure before bonding FOS to flexure. Element and time used at FOS Bond operation is shown in Table 4.1

Product	Ultra4
Operation	FOS Bond
Date	Jan 26, 1999
Location	C52, C53, C83
Prepared by	TASBONGKOT D.

Element No.	Element	FREQ.	AVG. Time	Select Time	Rating	Normal Time
1	Pick up JIT Tool tray from Kanban	5	1.60	0.32	100.00%	0.32
2	Turn Pie wedge out	1	1.03	1.03	100.00%	1.03
3	Load JIT Tool to Flipper	1	2.17	2.17	100.00%	2.17
4	Load FOS to flipper arm	1	2.22	2.22	100.00%	2.22
5	Apply epoxy on FOS	1	5.01	5.01	100.00%	5.01
6	Flip flipper arm	1	1.45	1.45	100.00%	1.45
7	Support Pie wedge	1	1.68	1.68	100.00%	1.68
8	Unload JIT Tool to tray	1	2.32	2.32	100.00%	2.32
9	Pick up tray	5	2.20	0.44	100.00%	0.44
10	Move flipper out	5	2.00	0.40	100.00%	0.40
11	Inspect & send JIT tool tray to convey	5	5.21	1.04	100.00%	1.04
12	Record data	5	1.80	0.36	100.00%	0.36
13	Open flexure tray	20	5.00	0.25	100.00%	0.25
		Summation time (sec)				18.69
		Hour per piece				0.005192
		UPH				193
		Capacity				10,943

Table 4.1 Motion and time of each element performed at Flex bond operation.

Current standard UPH of flex bond operation is only 193, its capacity is 10,943. That means this operation is one critical operation and need to be improved to increase cell capacity.

4.4 Problem Correction

Correcting problem at flex bond is advantageous from Gimbal bond process improvement because one element performed at gimbal bond effect the element that need to be performed at Flex bond operation. That element is turning pie wedge U-clamp and align it over the aligning pins of JIT tool to push flexure properly. After that pie wedge is needed to remove again at flex bond operation. Doing that is to allow to attach FOS on flexure sitting on JIT tool. Therefore, eliminating turning pie wedge and laying over flexure at gimbal bond operation will reduce some element that is performed at next operation, FOS Bond operation. FOS bond operators do not need to turning pie wedge again before they will perform their works. **Problem correction for this operation, therefore, eliminating removing the pie wedge U-clamp.**

4.5 Evaluation Factors and Procedures

4.5.1 Evaluation Factor

Lifted flexure is the only one factor that is needed to monitor in proposed method. Because there is nothing pushing flexure after flexure is already attached to slider sitting on slider and flexure may lift up while JIT Tools are moved to next operation, FOS Bond operation. Moreover flexure may lift up while JIT tools are moved from conveyor to flex bond station or moving from station to fixture.

4.5.2 Evaluation Procedures

Due to this proposed method is effect from Gimbal bond process improvement, therefore, the proposed method is planned to evaluate at he same time as gimbal bond operation. To monitor effect of new method, lifted flexure will be monitored and collected by flex bond operators on evaluating assembly line for one week.

4.6 Results of Evaluation

4.6.1 Lifted Flexure

To study the effect of eliminating turning in pie wedge at gimbal bond operation and removing pie wedge at flex bond operation, lifted flexure is monitored and collected by flex bond operation for one week (six working days). The result of collecting lifted flexure is shown in Table 4.2.

Result from implement proposed method on one assembly line for one week shows no lifted flexure found at flex bond at all.

	5/8	5/10	5/11	5/12	5/13	5/14
Loading	10578	10519	10524	10506	10596	10547
Defect	0	0	0	0	0	0
%Defect	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**
Mech Yield	99.34%	99.33%	99.37%	99.32%	99.35%	99.34%

Table 4.2 Data of lifted flexure were collected on each day.

4.6.2 New standard UPH

After the result of new proposed method shows no lifted flexure found at flex bond operation, motion and time study is performed again to measure time that is used for each new element performed at flex bond operation. This measurement is also to confirm standard time used for each element that is performed at flex bond operation. And new motion and time standard are shown in Table4.3

Product	Ultra4
Operation	FOS Bond
Date	May 25, 1999
Location	C52, C53, C83
Prepared by	TASBONGKOT D.

Element No.	Element	FREQ.	AVG. Time	Select Time	Rating	Normal Time
1	Pick up JIT Tool tray from Kanban	5	1.60	0.32	100.00%	0.32
2	Turn Pie wedge out	1	0.00	0.00	100.00%	0.00
3	Load JIT Tool to Flipper	1	2.17	2.17	100.00%	2.17
4	Load FOS to flipper arm	1	2.22	2.22	100.00%	2.22
5	Apply epoxy on FOS	1	5.01	5.01	100.00%	5.01
6	Flip flipper arm	1	1.45	1.45	100.00%	1.45
7	Support Pie wedge	1	1.68	1.68	100.00%	1.68
8	Unload JIT Tool to tray	1	2.32	2.32	100.00%	2.32
9	Pick up tray	5	2.20	0.44	100.00%	0.44
10	Move flipper out	5	2.00	0.40	100.00%	0.40
11	Inspect & send JIT tool tray to conveyor	5	5.21	1.04	100.00%	1.04
12	Record data	5	1.80	0.36	100.00%	0.36
13	Open flexure tray	20	5.00	0.25	100.00%	0.25
		Summation time (sec)				17.66
		Hour per piece				0.00491
		UPH				204
		Capacity				11,567

Table 4.3 New standard motion and time performed at flex bond operation.

4.7 Conclusion of Evaluation

1) Lifted flexure was monitored on one assembly line for one week (six working days) The result from each day show no lifted flexure found at flex bond bond at all. That means there is no effect from eliminating tuning pie wedge over flexure at gimbal bond operation and removing pie wedge at flex bond operation. However turning pie wedge over flex after FOS is already bonded to flexure is needed to maintain. Because it still need force to push FOS over flexure for complete attachment among FOS, flexure and slider.

2) Motion and time study is performed again by Industry Engineer to measure time that is used for each new element performed at flex bond operation. Motion and time of new standard of both old method and new method are compared as shown in Table4.4. Table shows time used for performing each element and also show standard UPH and operation capacity. From this study, new method can improve standard UPH from 193 to 204 and also increase operation capacity from 10,943 units loading per cell per day to 11,567 units loading per cell per day.

Element No.	Element	Old Method		New Method	
		FREQ.	Normal Time	FREQ.	Normal Time
1	Pick up JIT Tool tray from Kanban	5	0.32	5	0.32
2	**Turn Pie wedge out**	**1**	**1.03**	**0**	**0.00**
3	Load JIT Tool to Flipper	1	2.17	1	2.17
4	Load FOS to flipper arm	1	2.22	1	2.22
5	Apply epoxy on FOS	1	5.01	1	5.01
6	Flip flipper arm	1	1.45	1	1.45
7	Support Pie wedge	1	1.68	1	1.68
8	Unload JIT Tool to tray	1	2.32	1	2.32
9	Pick up tray	5	0.44	5	0.44
10	Move flipper out	5	0.40	5	0.40
11	Inspect & send JIT tool tray to conveyo	5	1.04	5	1.04
12	Record data	5	0.36	5	0.36
13	Open flexure tray	20	0.25	20	0.25
Summation time (sec)			18.69		17.66
Hour per piece			0.00519		0.00491
UPH			193		204
Capacity			10,943		11,567

Table 4.4 Compared data of time used for each element performed at flex bond operation.