Experimental Study on the Effect of Cleaning Agent Pressure on the Cleaning Process

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***Abstract*: Component cleaning is the most important process in any industry which removes unwanted material from the surface of the component to protect the component and increase the life of the product. In the cleaning process, the cleaning agent is used, and the pressure of that cleaning agent plays an important role. If a component is not completely cleaned, it might not function as required, and the entire operation is ineffective, just because of one unwanted piece of material.**
The main objective of this paper is to reduce the defects produce during the manufacturing of products and achieve zero-defect production. In this paper, we discussed how cleaning agent pressure affects the cleaning of the component with the help of an experimental study. For this experiment, we are considering a cleaning agent which should not support any moisture content. This experiment was done at various pressure ranges with a manual cleaning operation. For each pressure limit, single batch reading has been taken. The results of this experiment are measured in terms of defects produced.

***Keywords*: Cleaning, Cleaning Agent, Pressure, Defect**

Introduction –
In the manufacturing sector specifically, automobile use of assembly lines is very high. In the assembly process step by step, the component is assembled, where components must be completely immovable to enable consistent operation of the production process and ensures a high-quality product[1].
Accurate and firm mounting requires suitable fixtures. A fixture is a tool that holds a component during the manufacturing and assembly process. There are a number of types of fixtures available in the market. But for a complex product, fixtures are specifically designed and constructed as per customer requirements [2].
Fixture design and production cost is about 10–20% of the total production system costs. The use of fixtures in industrial processes with a high workpiece variability is expensive since many fixtures need to be designed to get for all probable variations [3]. So, to improve the reusability, fixture maintenance and cleaning are the most important.
The aim of any manufacturing industry is to improve productivity and product quality at the same time as maintaining a clean and sustainable environment [4].
Component cleaning is the process of removing unwanted constituents, like dirt, infectious agents, and other impurities. It is a most important and critical process which directly affects final product functioning [5].

Experiment procedure –
For this experiment, we have considered manual cleaning operations and certain below parameters -
1. Gas used for cleaning – Compressed Gas
2. Time for Pressure cleaning – 45 to 60 sec per component
3. Method of Cleaning – Manual Process
4. Trails took in Isolated space (Environmental Effects need not be considered)
The cleaning process was carried out according to the below manual steps –

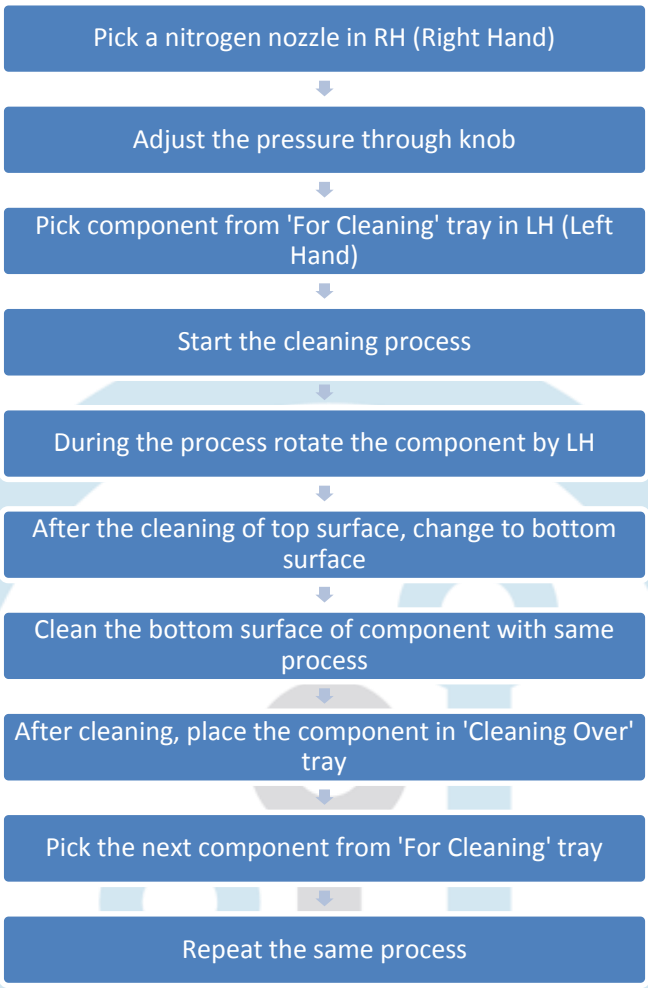
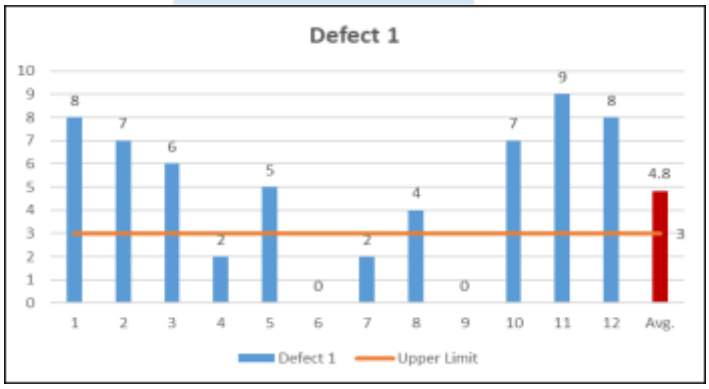


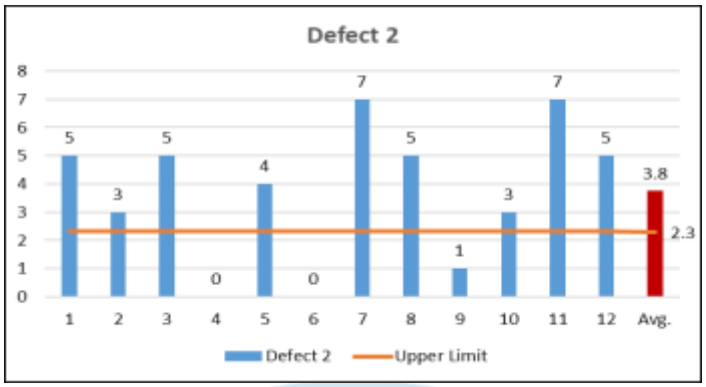
Figure 1 – Manual fixture cleaning process steps

Experimental Results –
The result of this experiment was calculated as the number of defective parts produced. For this, we have divided defects into two categories, one is defect-1 which is shown on the top surface, and the second is defect-2, defect-3 which is shown on the bottom of the surface.

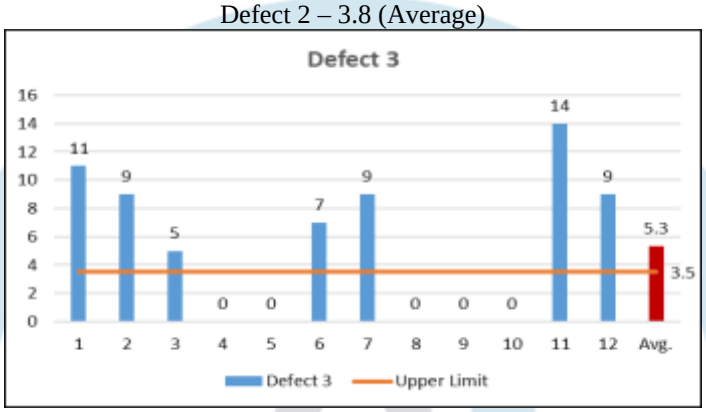
1. Experimental Trial - 1
Pressure cleaning at 'X' Bar –



Defect 1 – 4.8 (Average)



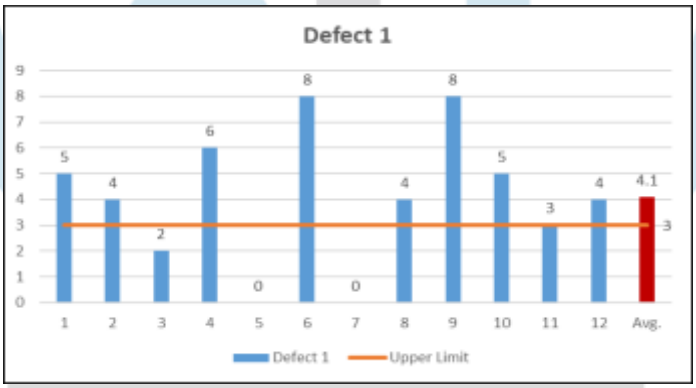
Defect 2 – 3.8 (Average)



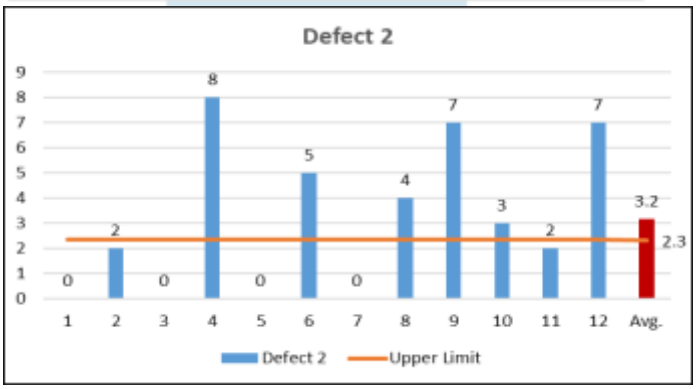
Defect 3 – 5.3 (Average)

2. <u>Experimental Trial - 2</u>

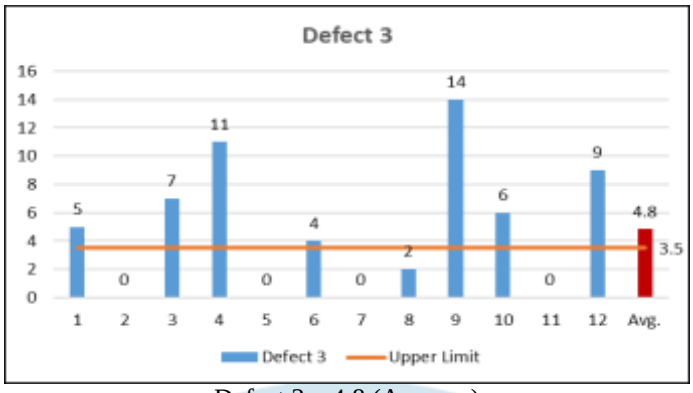
Pressure cleaning at 'X+1' Bar –



Defect 1 – 4.1 (Average)



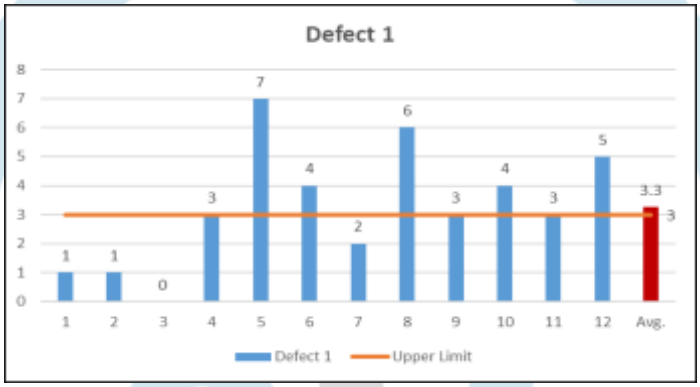
Defect 2 – 3.2 (Average)



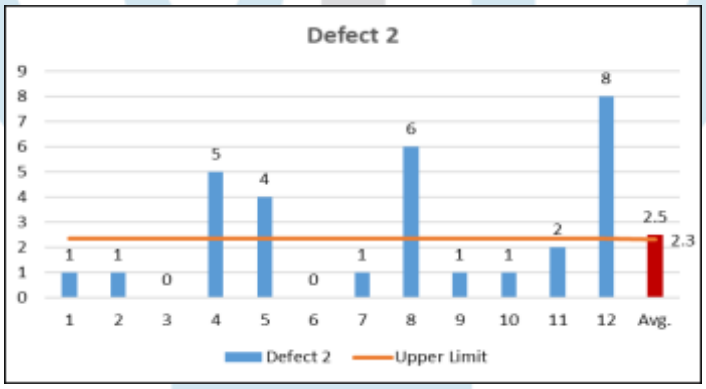
Defect 3 – 4.8 (Average)

3. <u>Experimental Trial - 3</u>

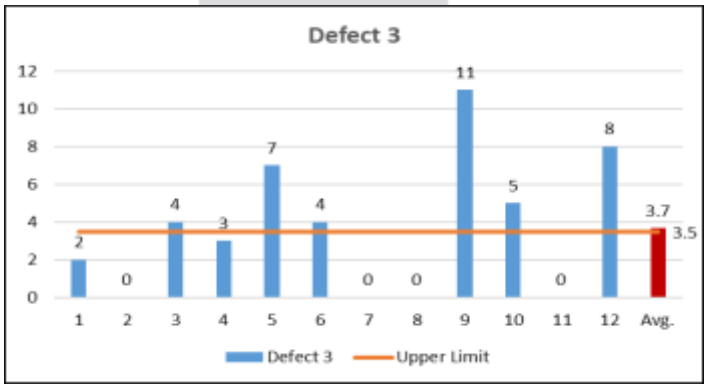
Pressure cleaning at 'X+2' Bar –



Defect 1 – 3.3 (Average)



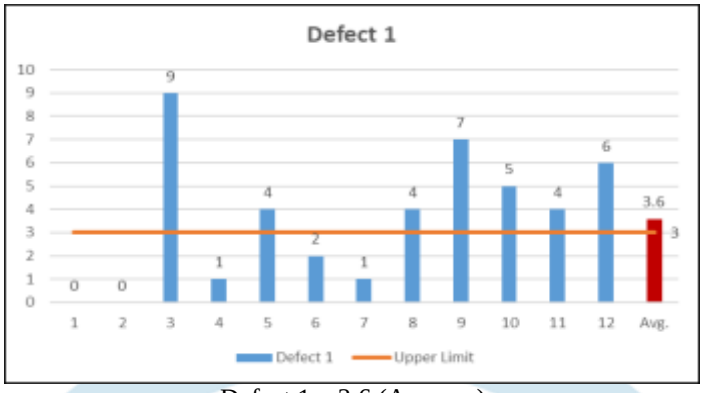
Defect 2 – 2.5 (Average)



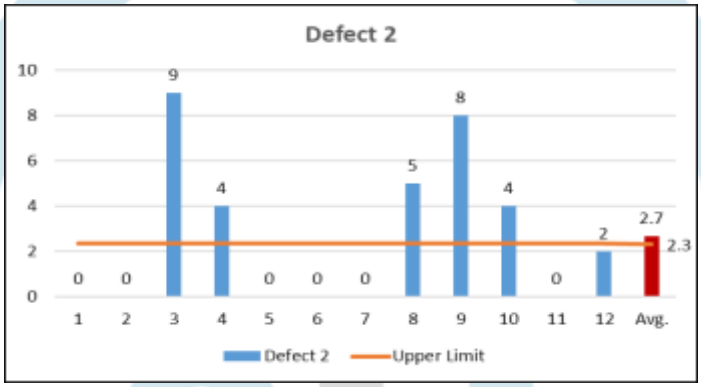
Defect 3 – 3.7 (Average)

4. Experimental Trial - 4

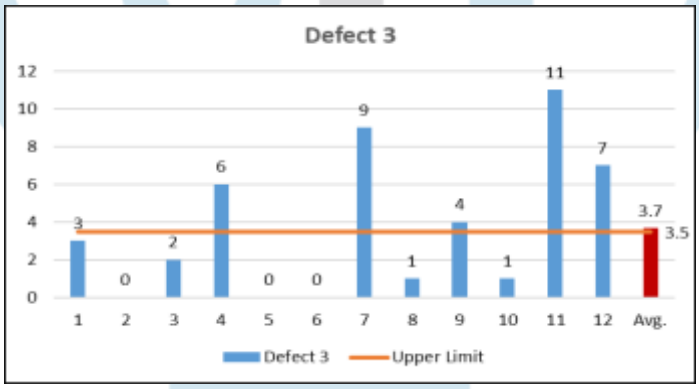
Pressure cleaning at 'X+3' Bar –



Defect 1 – 3.6 (Average)



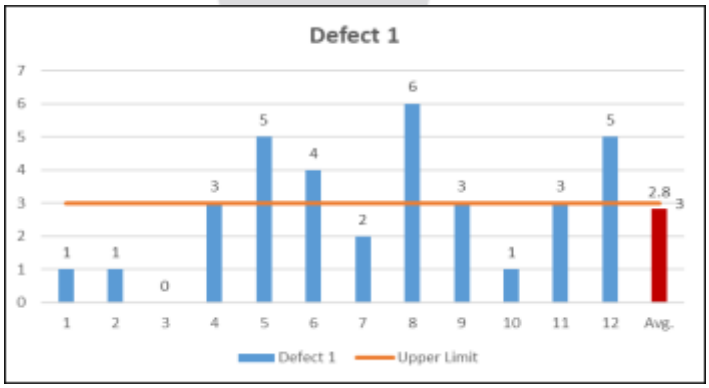
Defect 2 – 2.7 (Average)



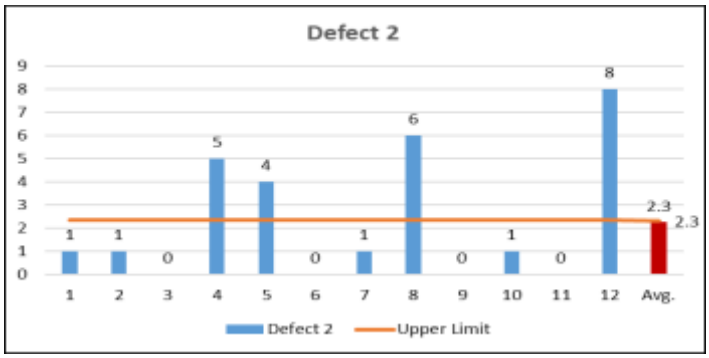
Defect 3 – 3.7 (Average)

5. Experimental Trial - 5

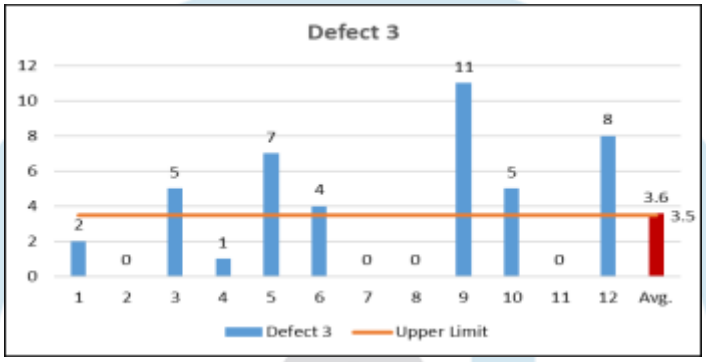
Pressure cleaning at 'Y' Bar –



Defect 1 – 2.8 (Average)



Defect 2 – 2.3 (Average)



Defect 3 – 3.6 (Average)

Conclusion –

In this experiment, a trial had been taken on a total of five pressure ranges and the results which got are given below.

Pressure	Defect 1	Defect 2	Defect 3
X Bar	4.8	3.8	5.3
X+1 Bar	4.1	3.2	4.8
X+2 Bar	3.3	2.5	3.7
X+3 Bar	3.6	2.7	3.7
Y Bar	2.8	2.3	3.6

Based on experimental results, the following conclusions can be drawn :

1. The trail was taken at X bar, X+1 bar, and X+2 bar pressure ranges, results which got are in reducing trend but not within the tolerance limit
2. When the next trail was taken at a X+3 bar pressure range, results showed an increasing trend
3. So as per data, we got to know that the acceptable pressure limit is between X+2 and X+3 bar where we got accepted results
4. To get the exact pressure, the next trial had been taken on Y bar pressure which is mid of both the pressure range and the results got within the tolerance limit and defects produced less as compared to all other pressure ranges.

References

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