CHAPTER 4

PROBLEM, SOLUTION AND CO_2 CLEANER EQUIPMENT DESIGN

4.1 Problem Identification

The problem from Base machine with metal particles contamination can make high scrap quantity. The data shows that the base machine can occur contaminant after dis-assembly process, especially the process screw removal. Therefore, the cleaning process effectiveness is needed to implement at the process after dis-assembly process. Another word, the reused base machine is needed to clean more effective before loading to normal manufacturing process. Figure 15 showed Spray LPC Monitoring (AVG) before/after cleaning by CO_2 cleaner. The data were collected from 7 weeks continuously. The result is very useful information, it can make us more understanding that the particles are significantly removed after applying CO_2 cleaner.
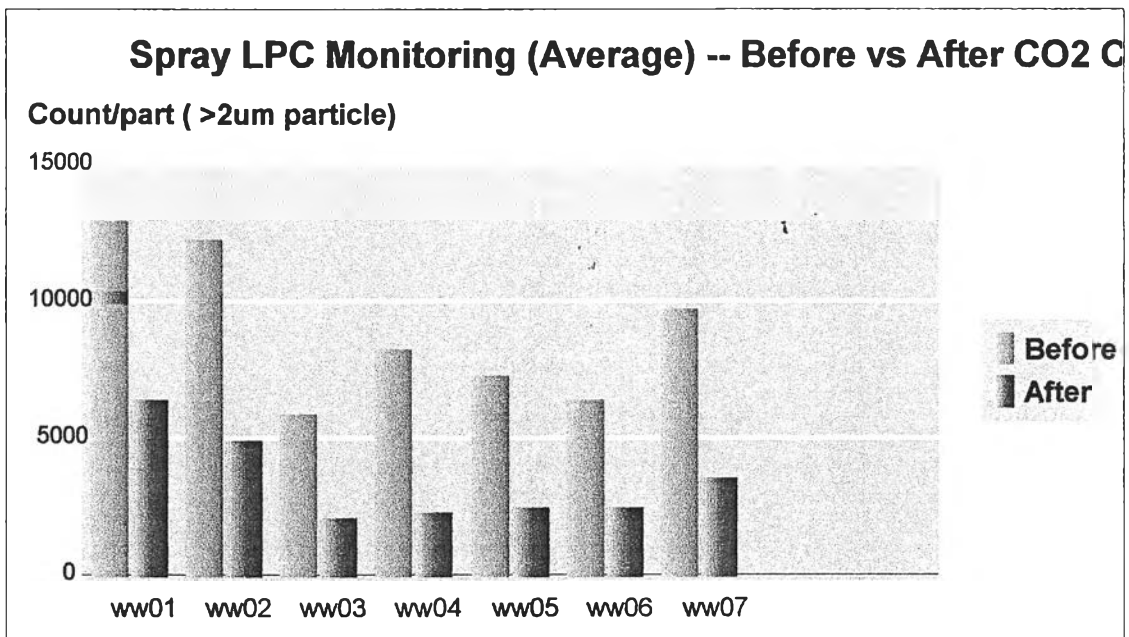
Figure 15 illustrated Spray LPC Monitoring (AVG) before/after cleaning by CO_2 cleaner
Source :Material Laboratory, IBM Storage Products (Thailand) limited.

The following table 5a and 5b are showed the data of average, maximum (MAX), Standard deviation (STD) and average + 3STD. This is relevant information to give us more details that the data goes in the same way under statistic.

Unit : Count/part

2003		ww01	ww02	Ww03	ww04	ww05	ww06	ww07
Before CO$_2$ Cleaning	Sample#1	10,253	7,208	7,392	9,379	7,869	5,789	5,637
	Sample#2	12,256	9,056	5,581	9,000	7,477	6,763	12,653
	Sample#3	16,584	20,429	4,957	6,339	6,448	6,853	10,997
	Average	13,031	12,255	5,977	8,239	7,265	6,468	9,764
	MAX	16,584	20,429	7,392	9,379	7,869	6,853	12,659
	STD	2,642	5,825	1,033	1,353	599	482	2,996
	AVG+3STD	20,957	29,731	9,075	12,297	9,062	7,914	18,753

Table 5a The particles of Base machine before CO$_2$ cleaning
Source :Material Laboratory, IBM Storage Products (Thailand) limited

Unit : Count/part

| 2003		ww01	ww02	Ww03	ww04	ww05	ww06	ww07
After CO$_2$ Cleaning	Sample#1	8,693	7,067	1,845	2,077	2,387	2,464	2,544
	Sample#2	5,229	4,680	2,275	2,152	1,643	1,984	4,405
	Sample#3	5,475	2,968	2,208	2,595	3,491	3,131	3,728
	Average	6,466	4,905	2,109	2,275	2,507	2,526	3,559
	MAX	8,693	7,067	2,275	2,595	3,491	3,131	4,405
	STD	1,578	1,681	189	229	759	470	769
	AVG+3STD	11,200	9,948	2,676	2,960	4,785	3,937	5,866

Table 5b The particles of Base machine after CO$_2$ cleaning
Source :Material Laboratory, IBM Storage Products (Thailand) limited

4.2 Problem causes

The reworked parts are strongly required to increase the part cleanliness level in every day. Currently, the contamination problem from cleaning process are major cause to make hard disk drive mul-function. From historical record of failure HDD, one of the problem came from metal contamination scratched on disk problem. Resulting from this company still have the product quality problem. Therefore, if cleaning method is determined not properly to remove the micro-contamination on the surface of parts, then the number of hard disk drive failed from contamination will be increased more quantity. That means we must scrap all those part. The phenomenon of this problem can show in error code "Hard Disk Interface (HDI)"

The HDI problem can cause scratch on disk surface. Referring to material analysis result, we found metal contamination (stainless SUS4xx i.e. component material) embedded on disk and head. See figure 16 showed scratched on disk, we took a picture below with Scanning Electron Microscope (SEM).
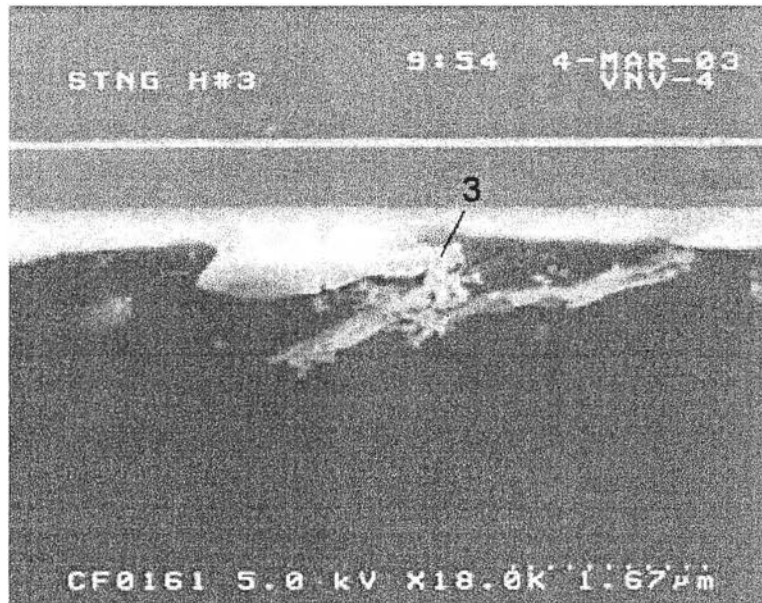
Figure 16 illustrated scratched problem on disk problem
Source :Material Laboratory, IBM Storage Products (Thailand) limited.

Another HDI defected is Scratch and Erasure (with/without scratch) on disk surface. Referring to material analysis result, we found metal contamination (stainless SUS3xx i.e. component & tooling material) embedded on disk head. See figure 17 showed scratched on disk, we took a picture below with Scanning Electron Microscope
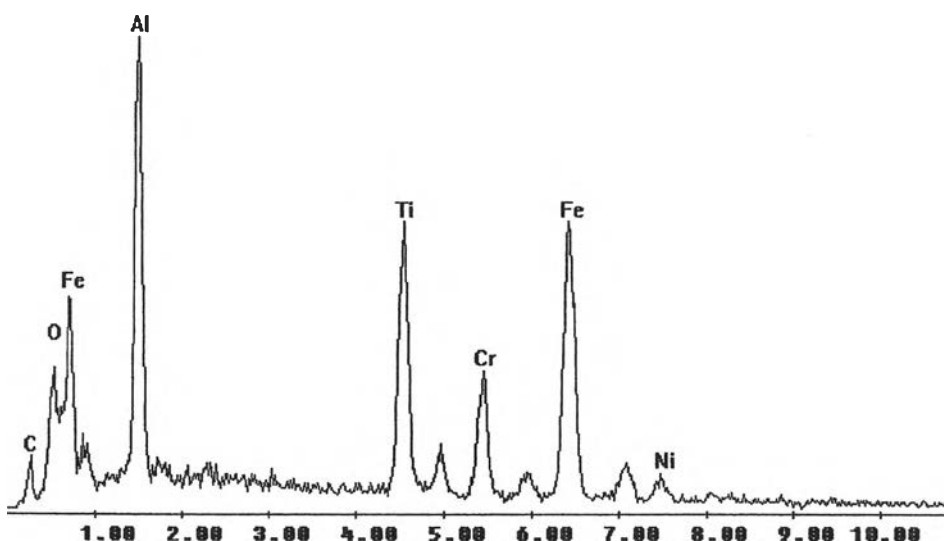

Figure 17 illustrated scratched problem on disk problem
Source :Material Laboratory, IBM Storage Products (Thailand) limited

Figure 18 illustrated the spectrum of contamination were detected by means of SEM
Source :Material Laboratory, IBM Storage Products (Thailand) limited

4.3 Solution

New method and approach are considered to implement in order to make more effective cleaning, fast working and low cost.

The purpose of study is to identify appropriate Carbon Dioxide cleaning conditions to HDD reworked parts in company. This study is to provide the real information and tangible approach to actual cleaning operation. We use factorial design to define an appropriate condition of CO_2 cleaner for re-use Base Spindle. The purpose is to improve cleaning effectiveness and cost saving as well.

The Spray Liquid Particle Count (LPC) measurement technique will be used to evaluate cleanliness of reuse Base Spindle. This measurement technique will be explained in chapter?.

What we expect to gain benefit after we apply this solution
- Return On Investment (ROI) decision making.
- Part cleanliness problem.
- Scrap part Reduction.
- An appropriate condition of CO_2 cleaner