



## CHAPTER 5

### CO<sub>2</sub> CLEANER EQUIPMENT DESIGN AND OPERATION

#### 5.1 CO<sub>2</sub> Cleaner Equipment Design

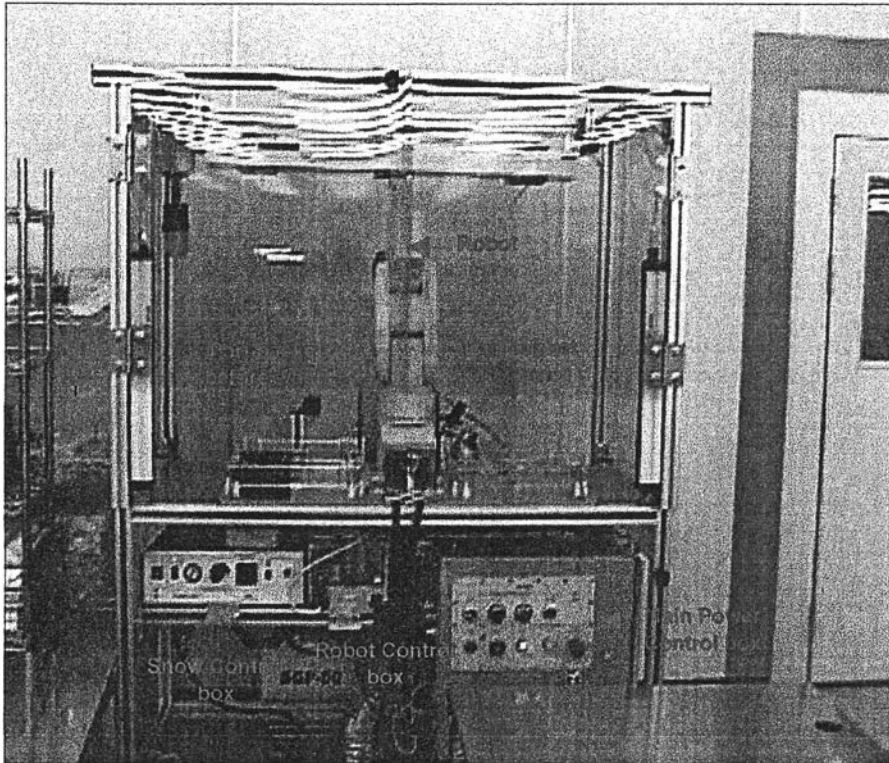
In general, the DEFLEX PowerSno, Model PS6000, delivers a precisely controlled stream of solid carbon dioxide particles at high velocity. By selecting the appropriate nozzle and making the necessary propellant pressure and temperature adjustment, it will clean to a variety of surface cleanliness levels.

The machine is essentially simple and uncluttered yet provides sophisticated cleaning spray control. All the necessary controls to operate the cleaning system reside on the front control panel. Controls include a main power switch, propellant stand-by switch, propellant pressure/flow regulating valve and heater condition indicators, snow priming switch, liquid carbon dioxide injection micrometering valve, and a grounded coaxial spray line with pistol grip applicator. The basic system employs a durable dual footswitch control allowing for spray cleaning and gas (optionally ionized) purging of spray cleaned surfaces. The basic mechanisms employed, and in particular the SnoShear spray cleaning technology, are protected under patent and pending patents.

All the component parts are manufactured to the highest commercial standards and are selected or designed for maximum life consistent with reasonable cost.

CO<sub>2</sub> cleaner's equipment consists of: Item 1-5 see figure 19 for reference.

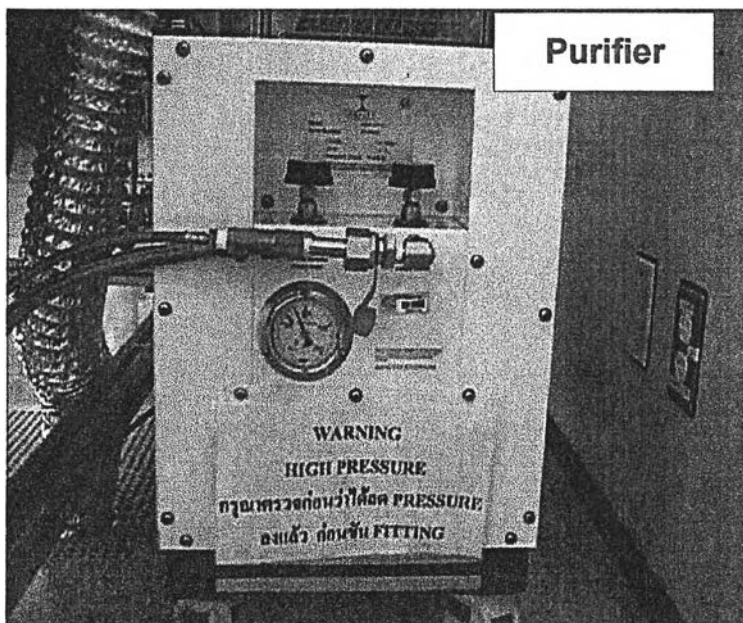
1. **Robot** has function to gather part, move part and hold part while CO<sub>2</sub> cleaning
2. **Main power control box** is electric power box for robot movement and snow controlling. CO<sub>2</sub> gas will be purged out from control box, the system allows CO<sub>2</sub> liquid flow from control box to snow control box.
3. **Robot Control Box** has function to control robot movement, the program can be updated and saved in box. The back-up battery is available for stand by and emergency use purpose.
4. **Snow Control Box** has function to control snow amount, pressure and heat-up to purge snow throughout nozzle.
5. **Basket for part before /after wash** is used for Base Motor containing before/after cleaning.



**Figure 19** illustrated CO<sub>2</sub> cleaner equipment set

Source :Cleaning Engineering, IBM Storage Products (Thailand) limited.

**6. Purifier** the device is designed for precision cleaning system. Its purpose is to take inexpensive low grade CO<sub>2</sub> from a CO<sub>2</sub> cylinder and convert it into ultra pure bone dry CO<sub>2</sub>.



**Figure 20** illustrated CO<sub>2</sub> purifier

Source :Cleaning Engineering, IBM Storage Products (Thailand) limited

## 7. CO<sub>2</sub> gas tank.



**Figure 21 illustrated CO<sub>2</sub> gas tank**

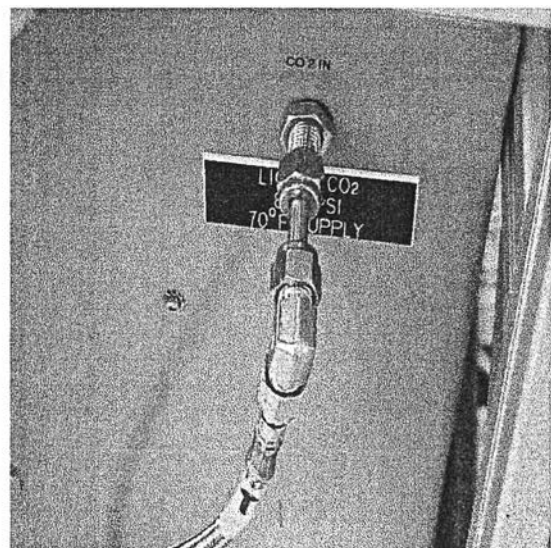
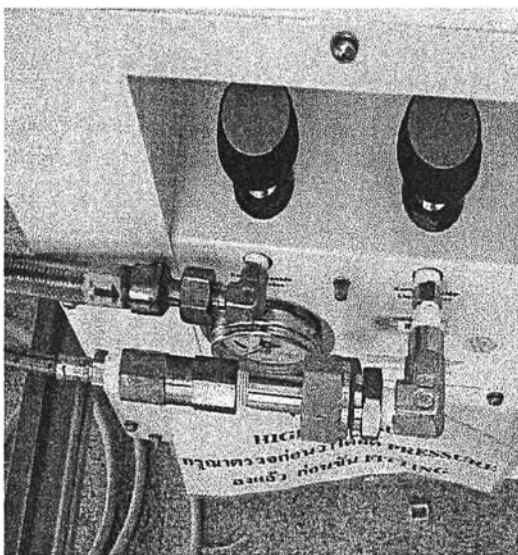
*Source :Cleaning Engineering, IBM Storage Products (Thailand) limited*

## 5.2 CO<sub>2</sub> cleaner Installation

After we get all equipment and accessory as per requirement in 5.1, then we plan to install CO<sub>2</sub> cleaner in the following sequence operation.

### CO<sub>2</sub> cleaner installation

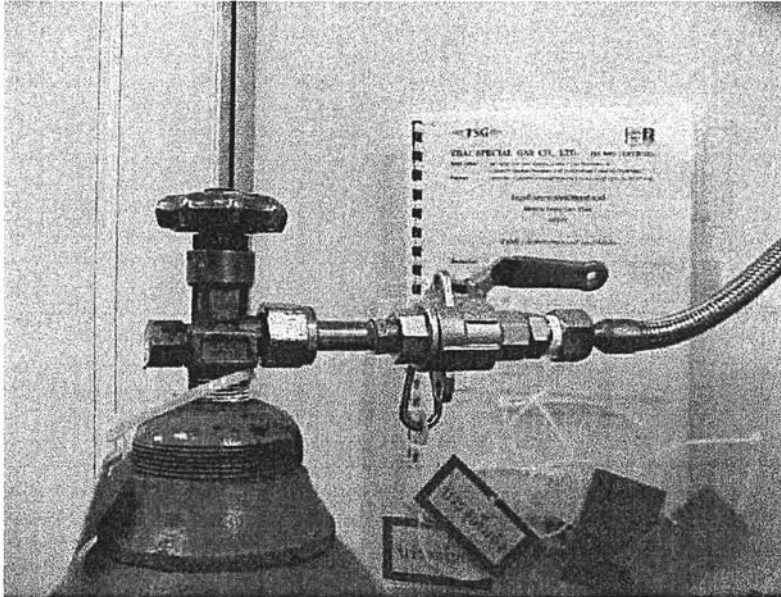
1. Set up CO<sub>2</sub> cleaner and purifier at Disassembly line. The rework part will be sent to re-cleaning at dis-assembly before part is re-used.
2. Place CO<sub>2</sub> tank at outside cleanroom. To keep cleanroom condition, we put CO<sub>2</sub> at outside, the main reason that CO<sub>2</sub> tank is quite dirty and difficult to clean-up completely. (See figure 21)
3. Connect purifier to CO<sub>2</sub> cleaner with flex cable and fitting



**Figure 22 illustrated Connect purifier to CO<sub>2</sub> cleaner with flex cable and fitting**

*Source :Cleaning Engineering, IBM Storage Products (Thailand) limited*

#### 4. Connect purifier to CO2 tank.



**Figure 23 illustrated Connect purifier to CO2 tank**

*Source :Cleaning Engineering, IBM Storage Products (Thailand) limited*

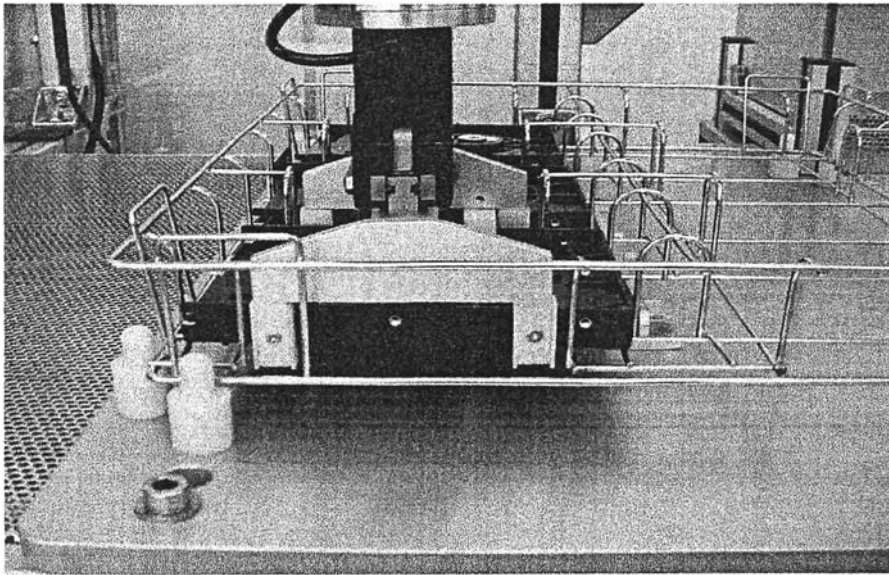
#### 5. Connect electric power(AC 100V.) of CO2 cleaner and purifier

### 5.3 Principles of Operation

Gas under pressure flows through a pressure regulator, heater, and filtration cartridge to form a variably controlled propellant – which flows through a co-axial delivery assembly containing an outer propellant delivery line (propellant tube) and an inner snow particle cleaning agent line delivery line (snow particle tube). The propellant tube and snow particle tube are integrated within a convergent, parallel, or divergent mixing nozzle. The propellant passes into the mixing nozzle that contains the snow particle tube, which is self-centering within the mixing nozzle by the propellant stream, and either accelerates or decelerates the snow stream, depending upon the type of nozzle used. Through momentum transfer, a significant transfer of energy is exchanged between the supersonic propellant stream and the subsonic snow particle stream forming the SnoShear stream.

### 5.4 CO<sub>2</sub> cleaner Operation

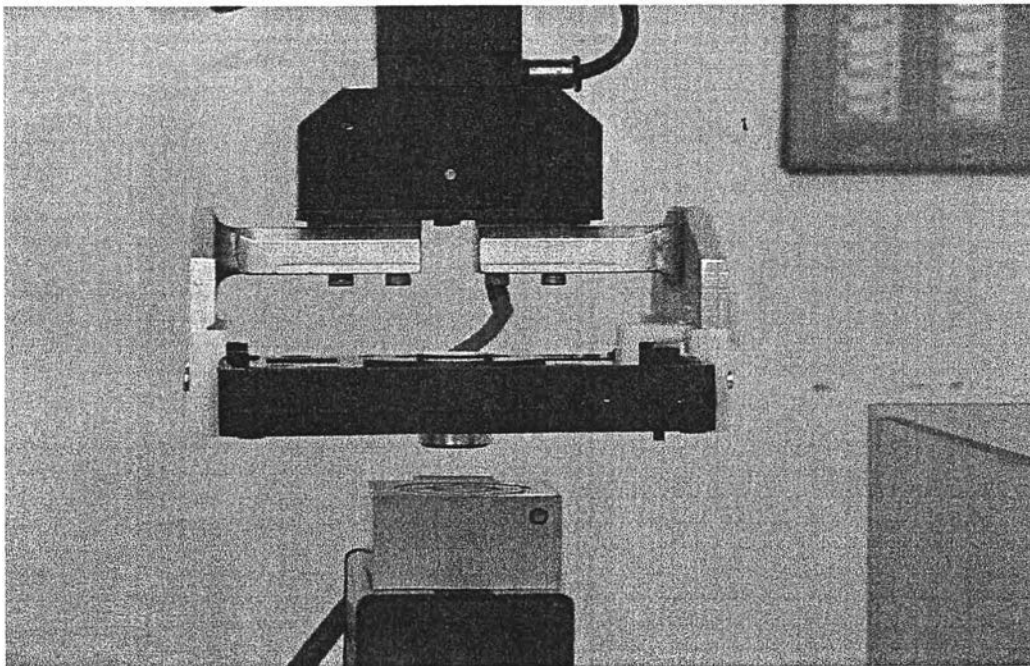
1. CO<sub>2</sub> cleaner robot gathers part from basket before washing (on the left side of CO<sub>2</sub> cleaner).



**Figure 24 illustrated Robot gathers part from basket before washing**

*Source :Cleaning Engineering, IBM Storage Products (Thailand) limited*

2. The sensor detector at grip lock has function to confirm part won't fall down during cleaning operation .

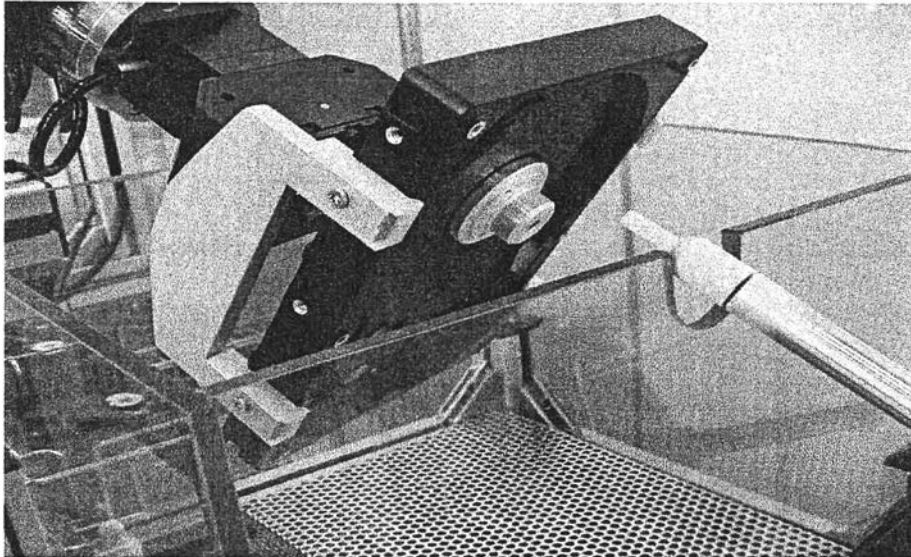


**Figure 25 illustrated sensor detector at grip lock**

*Source :Cleaning Engineering, IBM Storage Products (Thailand) limited*



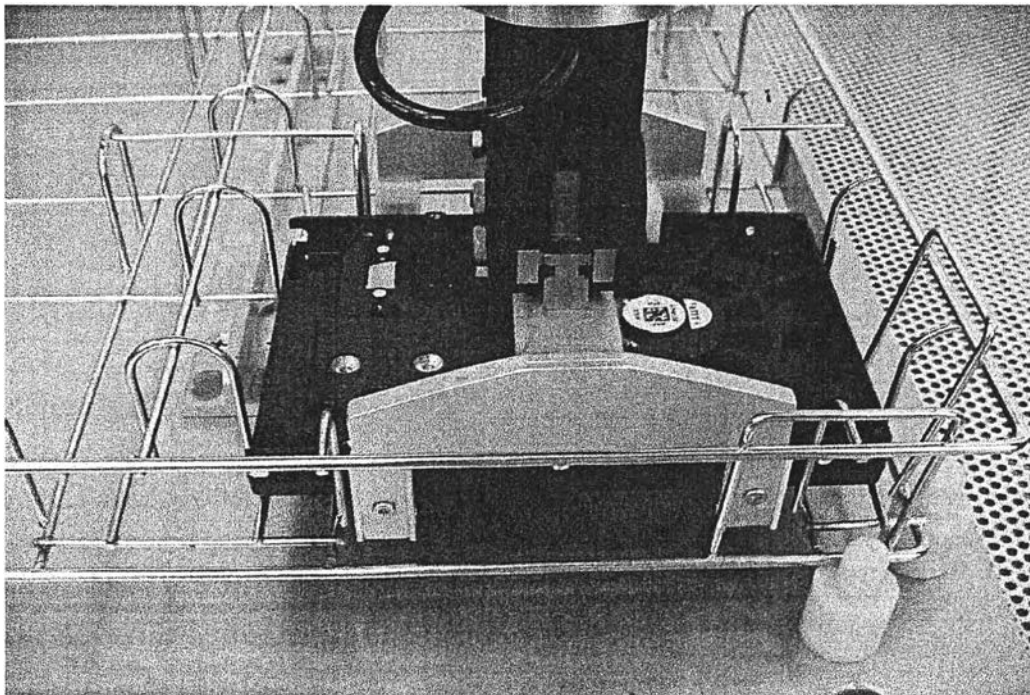
3. Cleaning the part with CO<sub>2</sub> nozzle. The CO<sub>2</sub> will be automatically spray out after Base Motor is in setting position.



**Figure 26 illustrated sensor detector at grip lock**

*Source :Cleaning Engineering, IBM Storage Products (Thailand) limited*

4. After cleaning operation is completed, Robot will carry the part to basket on the right side of CO<sub>2</sub>. The cleaned Base Motor is now ready to use for new build.



**Figure 27 illustrated putting to cleaned Base Motor on the basket right side**

*Source :Cleaning Engineering, IBM Storage Products (Thailand) limited*