Dust Controller System Modification

K. M. Arunraja[1] Akash M P[2] Amal Krishna K S[3]
[1.] Assistant Professor
[2&3] Student ,
Department of Mechanical Engineering
Hindusthan Institute of Technology, Coimbatore, India

***Abstract:-* Here we modified a small variation in the DC machines.. The problem arises from the fact that the DC machines produces dust while during the operation . As due to this it creates a lot of problem to the workers in the company. So in order to this we have studied about the DC machines structure and found out some of the errors in the DC machines. Thus we have modified a small variation in the DC machines to avoid dust.**

1. INTRODUCTION:

Dust collectors are used in many processes to either recover valuable granular solid or powder from process streams, or to remove granular solid pollutants from exhaust gases prior to venting to the atmosphere. Dust collection is an online process for collecting any process- generated dust from the source point on a continuous basis. Dust collectors may be of single unit construction, or a collection of devices used to separate particulate matter from the process air. They are often used as an air pollution control device to maintain or improve air quality.

Mist collectors remove particulate matter in the form of fine liquid droplets from the air. They are often used for the collection of metal working fluids, and coolant or oil mists. Mist collectors are often used to improve or maintain the quality of air in the workplace environment. Fume and smoke collectors are used to remove sub micrometer size particulate from the air.

2. DUST COLLECTOR SYSTEM:

A dust collector is a system used to enhance the quality of air released from industrial and commercial processes by collecting dust and other impurities from air or gas. Designed to handle high volume dust loads, a dust collector system consists of a blower, dust filter, a filter-cleaning system, and a dust receptacle or dust removal system. It is distinguished from air purifiers, which use disposable filters to remove dust.

A dust collection system is an air quality improvement system used in industrial, commercial and home production shops to improve breathable air quality and safety by removing particulate matter from the air and environment. Dust collection systems work on the basic formula of capture, convey and collect.

<u>Inertial separators</u>

Inertial separators separate dust from gas streams using a combination of forces, such as centrifugal, gravitational, and inertial. These forces move the dust to an area where the forces exerted by the gas stream are minimal. The separated dust is moved by gravity into a hopper, where it is temporarily stored.

The three primary types of inertial separators are:

- Settling chambers
- Baffle chambers
- Centrifugal collectors

Neither settling chambers nor baffle chambers are commonly used in the minerals processing industry. However, their principles of operation are often incorporated into the design of more efficient dust collectors.

<u>Settling Chamber</u>

the speed of the dust filled airstream and heavier particles settle out. Settling chambers are simple in design and can be manufactured from almost any material. However, they are seldom used as primary dust collectors because of their large space requirements and low efficiency. A practical use is as precleaners for more efficient collect.

<u>Buffle Chamber</u>

Baffle chambers use a fixed baffle plate that causes the conveying gas stream to make a sudden change of direction. Large- diameter particles do not follow the gas stream but continue into a dead air space and settle. Baffle chambers are used as precleaners.

<u>Centrifugal Collector</u>

Centrifugal collectors use cyclonic action to separate dust particles from the gas stream. In a typical cyclone, the dust gas stream enters at an angle and is spun rapidly. The centrifugal force created by the circular flow throws the dust particles toward the wall of the cyclone. After striking the wall, these particles fall into a hopper located underneath. A settling chamber consists of a large box installed in the ductwork. The increase of cross section area at the chamber reduce

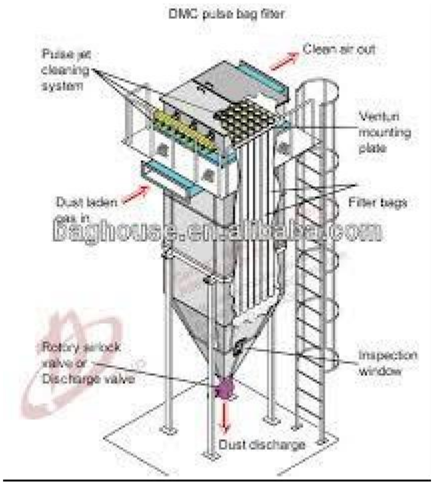

Fig 1 Baghouse C0llector

3. WORKING OF DUST COLLECTOR:

Most baghouses use long, cylindrical bags (or tubes) made of woven or felted fabric as a filter medium. For applications where there is relatively low dust loading and gas temperatures are 250 °F (121 °C) or less, pleated, nonwoven cartridges are sometimes used as filtering media instead of bags.

Dust-laden gas or air enters the baghouse through hoppers and is directed into the baghouse compartment. The gas is drawn through the bags, either on the inside or the outside depending on cleaning method, and a layer of dust accumulates on the filter media surface until air can no longer move through it. When a sufficient pressure drop (ΔP) occurs, the cleaning process begins. Cleaning can take place while the baghouse is online (filtering) or is offline (in isolation). When the compartment is clean, normal filtering resumes.

Baghouses are very efficient particulate collectors because of the dust cake formed on the surface of the bags. The fabric provides a surface on which dust collects through the following four mechanisms.

Pulse jet bag filters can be operated continuously and cleaned without interruption of flow because the burst of compressed air last for only a very short period of time, typically less than a second. Because of this continuous cleaning feature, maximum utilization of the fabric area can be achieved.

Pulse jet cleaning is more intense and occurs with greater frequency than the other fabric filter cleaning methods (mechanical shaker and reverse air) to keep the unit from having a high pressure drop across the filter. The intense cleaning dislodges nearly all of the dust cake each time the bag is pulsed. As a result, pulse jet filters do not rely on a dust cake to provide filtration. Usually felted (nonwoven) fabrics are used in pulse jet filters because they do not require a dust cake to achieve high collection efficiencies. However, sometimes woven bags are also used in a pulse jet filters in cases where a dust cake is desired. It has been found that woven fabrics used with pulse jet filters leak a great deal of dust after they are cleaned.

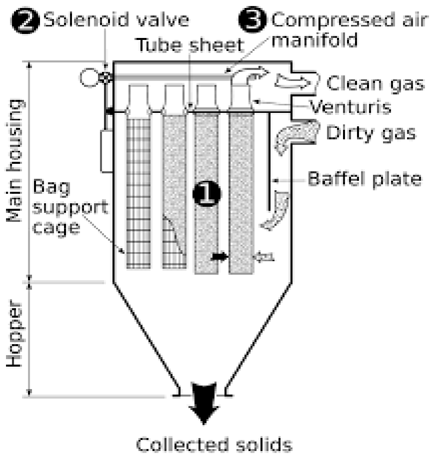

Fig 2 Solenoidal Baghouse

4. OVERVIEW OF INDUSTRIAL DUST COLLECTOR:

Using digital anemometer we measured the air flow velocity of dust collector system connected to the elevator and the air velocity difference in the suction point and delivery point is noted as below:

MACHIN E NAME	DIAMETE R (in m)	VELOCIT Y (in m/s)
Elevator 1	0.22	2.33
Elevator 2	0.22	3.41
Elevator 3	0.22	4.4
Elevator 4	0.22	4
Elevator 5	0.22	3.2
Elevator 6	0.22	3.6
Elevator 7	0.22	2.3
Elevator 8	0.22	3.5
Elevator 8	0.22	4.1
Elevator 9	0.22	2.2
High Force Magnetic Separator (HFM)1	0.11	9.44
HFM 2	0.11	8.61
HFM 3	0.11	7.82
Bar Mac	0.16	5.65
Raymond Mill	0.16	3.2
Roller Crusher 1	0.16	1.84
Roller Crusher 2	0.16	2.12
Magensen Sizer	0.18	0.1
Rotex 1	0.18	3.85
Rotex 2	0.18	2.35
Rotex 3	0.18	2.80
Rotex 4	0.18	2.54
Rotex 5	0.18	3.22
Rotex 6	0.18	1.67

5. STEPS TAKEN TO INCREASE THE AIR FLOW VELOCITY:

The initial dust source is from the elevators in which the DC is connected only in the suction and delivery point. As we measure the air flow velocity in all the machines connected to the DC line, we found that the air flow velocity is slower in the elevators. So we need to remove the dust in the elevators completely as the initial step. As the DC line is connected only in the suction and delivery point the dust in between the elevator is stucked and these dust is passed to all other machines. In order to remove the dust in between the elevator the DC line should be connected to any face of the elevator. As the DC line is connected to face of the elevator the dust inbetween can be removed and the dust particles stucked will be removed which will also increase the air flow velocity in the suction and delivery point of the elevator. As the initial dust are removed from the elevator, no more dust will not enter into the other machines which will avoid the dust problem in an efficient way.

Also as we study the DC line in nthe industry the design also seems to be not comfortable for the best level. As shown in the figure below the connections are done in a series way. But as per the design procedure the Y shape connections are done in which the dust inside the pipe can flow easily and which will maintain the air flow velocity.

Fig 3 Dust Collector System

This process can be divided into two stages. The first stage involves sizing your duct work for adequate volume (CFM) and velocity (ft/m) for the type of dust you will be handling. Then in the second phase you calculate the static pressure (SP) of your system to determine the size of your baghouse (how many filters and what size) and power of your system fan.

If you already have a ductwork system and want simply to replace an existing baghouse/fan combo, you still need to calculate the CFM and static resistance from the existing ductwork system to properly size the baghouse and/or fan.

6. CONCLUSION:

We studied about the dust controller machine system and found out that dust controller supply was connected only in the suction and delivery point. We measured the suction velocity and the speed was not enough to clear the dust in between the elevators. So the initial problem start from the suction point of the elevator . Inorder to avoid this we made another dust controller connection to the phase of the elevator. So the dust in between the elevators been sucked out with higher velocity which will avoid the dust resolution problem in the industry.

7. REFRENCE:

1. Sandor Nagyszalanczy , Woodshop Dust Control, A Complete Guide To Setting Up Your Own Dust Control System.
2. Miles L.Croom , Filter Dust Collectors , A Design and Application.
3. Dust Collection Basics, A Textbook For Dust Collection System
4. https://en.m.wikipedia.org/wiki/Dust_colle ction_system
www.gcesystems.com/pulse-jet-bag-filter- dust-collector-html.html