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DESIGN AND FABRICATION OF UNIT MODULAR DUST COLLECTOR

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ABSTRACT- *The trend among mechanical industries to develop selective granular solid of high potential has pushed the industry to consider the potential of each hazardous ingredient to become airborne. Dustiness issues are not unique to the mechanical industry, but are relevant to any industry where powdered materials are mixed, transferred and handled. Interest in dustiness is also driven by concerns for workers health, the potential for plant explosions and the prevention of product loss. Unlike other industries, the mechanical industry is limited by the milligram quantity of solid material available for testing during product development. 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. In this project we are going to design UNIT MODULAR DUST COLLECTOR, also called as bag filter. We need to sketch 2D Design from AUTOCAD. Then 2D is converted to 3D in CATIA. In general, the finer the particles that have to be collected, the higher will be the cost of a suitable separation system.*

Keywords*: Collector, design, dust removal system, filter, fabrication*

1. INTRODUCTION

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 mechanical equipment's. Dust collector are used in many processes to either recover valuable granular solid or powder from industrial processes.Bulk material consists of relatively large and heavy particles, with no fine dust, it may be possible to collect the material in a dust bin, where the solid material falls under gravity to the bottom of the bin while the gas is taken off through a suitable vent. Many construction details such as inlet location, hopper design, bin design, casing, blower, impeller and motor. It is widely involved in many industrial processes such as welding, rubber, and plastic, etc**.** In view of above, information about working of bag type filters, materials, and different types of bag type design considerations, maintenance and useful terms related with filters is given. Gas-solid separation devices associated with pneumatic conveying systems have two functions. To recover the conveyed material as much as possible and to minimize pollution of the environment by the working material. Different separation mechanisms used based on the size of particles are: gravity settling chambers, cyclone separators and bag type fabric filters. If a bulk material consists of relatively large and heavy particles, with no fine dust, it may be possible to collect the material in a simple bin, where the solid material falls under gravity to the bottom of the bin while the gas is taken off through a suitable vent.

However, if a bulk material is of slightly smaller particle size, it may be required to enhance the gravitational effect. The most common method for this is to impart spin to the gas-solid stream so that the solid particles are thrown outwards while the gas is drawn off from the centre of the vortex. A cyclone separator works on this principle.

If particles are fine and especially if they are also of low density, separation in a cyclone may not be fully effective, and in this case the gas-solid stream may be vented through a fabric filter. For materials containing extremely fine particles or dust, further refinement in the filtration technique may be necessary, for example, use of wet washers or scrubbers and electrostatic precipitators. In general, the finer the particles that have to be collected, the higher will be the cost of a suitable separation system. Airborne dusts which may be encountered in industrial situations are generally less than about 10µm in size. Particles of this size can be taken into the body by ingestion, skin absorption or inhalation. The former is rarely a serious problem and, although diseases of the skin are not an infrequent occurrence, it is inhalation that presents the greatest hazard for workers in a dusty environment. Particles falling in the size range of approximately 0.5 - 5 µm, if inhaled, can reach the lower regions of the lungs where they will be retained. Prolonged exposure to such dusts can cause permanent damage to the lung tissues

(pneumoconiosis) symptomized by shortness of breath and increased susceptibility to respiratory infection. In view of above, information about working of bag type fabric filters, fabric materials, and different types of bag type fabric filters, design considerations, maintenance of fabric filters (pulse jet type) and useful terms related with bag filters is given in this booklet.

2. INTENSION OF DUST COLLECTOR

In simple word-a suction hood is placed near the source point. This suction hood is connected to the dust collector which sucks in air and the dust comes along with it. This dust is separated from the carry air and the clean air is allowed to escape, either within the premises or outside.

2.1 PROBLEMS OCCUR

Now a days mechanical equipment's are chemical based and hazardous, so it will affect humans. It will affect productivity. These materials or chemicals cannot be collected by humans accurately and requires more time Stagnation of this chemicals or materials may cost the machine.

2.2 OBJECTIVES

Affecting chemical substances can be controlled by dust collector. It is designed to handle high volume dust loads. It can increase manufacturing process. They are often used as an air pollution control device to maintain or improve air quality. Accuracy is good and can save time. Using dust collector will reduce the work from man power.

3. SALIENT FEATURES OF DUST COLLECTOR

Dust Extractor Machine is provided with Hot Rolled withstand up to 1700° F. In this Dust Extractor Machine, Blower fan is dynamically balanced and the unit is with castor wheels. Overcome dust hazards as well as cross contamination at welding compression. Minimizes mechanical strain, excessive wear of tableting machine-resulting in minimum machine break-downs and punch wears. Inlet manifolds and dust collection bin are of H.R. The inlet manifolds facilitate to connect Machine and the De-dusting units. Machine in fitted with the castor wheels for easy mobility. High body inlet model allows higher air-to media ratio on lighter dusts. Square models help minimize ducting and accessory costs. Welded design increase durability. Tool-free installation of bag filters and cages. Dust collectors vary widely in design, operation, effectiveness, space requirements, construction, and capital, operating, and maintenance costs. Each type has advantages and disadvantages. However, the selection of a dust collector should be based on the following general factors:

Dust concentration and particle size - For minerals processing operations, the dust concentration can range from 0.1 to 5.0 grains (0.32 g) of dust per cubic feet of air (0.23 to 11.44 grams per standard cubic meter), and the particle size can vary from 0.5 to 100 µm. Degree of dust collection required - The degree of dust collection required depends on its potential as a health hazard or public nuisance, the plant location, the allowable emission rate, the nature of the dust, its salvage value, and so forth. The selection of a collector should be based on the efficiency required and should consider the need for high-efficiency, high-cost equipment, such as electrostatic precipitators; high-efficiency, moderate-cost equipment, such as bag houses or wet scrubbers; or lower cost, primary units, such as dry centrifugal collectors.

Characteristics of airstream - The characteristics of the airstream can have a significant impact on collector selection. For example, cotton fabric filters cannot be used where air temperatures exceed 180° F (82°C). Also, condensation of steam or water vapor can blind bags. Various chemicals can attach fabric or metal and cause corrosion in wet scrubbers. Characteristics of dust - Moderate to heavy concentrations of many dusts (such as dust from silica sand or metal ores) can be abrasive to dry centrifugal collectors. Hygroscopic material can blind bag collectors. Sticky material can adhere to collector elements and plug passages. Some particle sizes and shapes may rule out certain types of fabric collectors. The combustible nature of many fine materials rules out the use of electrostatic precipitators. Methods of disposal - Methods of dust removal and disposal vary with the material, plant process, volume, and type of collector used. Collectors can unload continuously or in batches. Dry materials can create secondary dust problems during unloading and disposal that do not occur with wet collectors.

4. WORKING PRINCIPLE

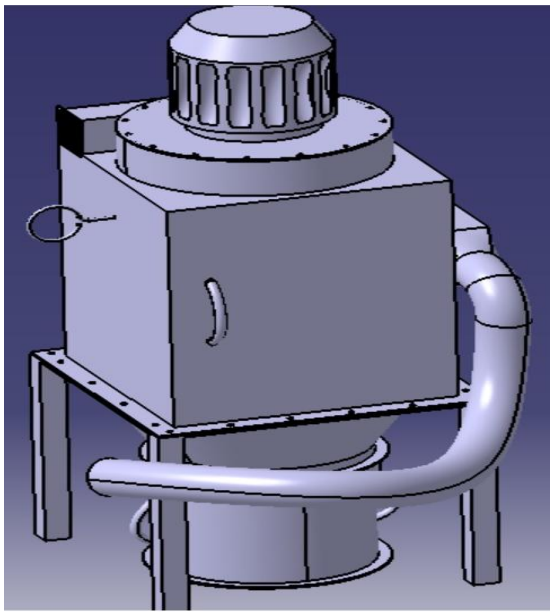
Unit modular dust extractor machine is extremely useful in controlling the dust generated during the processes of granular solid. This equipment are used to remove excess of electrode from the rod. These Dust Extractor Machine is not only ensure a dust free end product for use but also health and safety of people coming in contact with mechanical processing machines. Extracting hazardous dust at the point of origination and conveying them to the correctly designed filtration system is

necessary to protect both personnel as well as the plant. This Dust Extractor Machine successfully captures dust with the air stream and conveys it to the dust collector.

In pneumatic conveying systems handling fine or dusty material, the method of filtration that has become almost universally adopted is a bag type filter. These filters are commonly called bag houses. Most bag houses use long, cylindrical bags (or tubes) made of woven or felted fabric as a filter medium. Dust laden gas or air enters the bag house through hoppers by suction (normally) or positive pressure and is directed into the bag house compartment. The heavier dust particles fall off at the entry itself, while the lighter dust particles along with gas get carried upward to the bags. The gas is drawn through the bags, either on the inside or the outside depending on cleaning method, and dust accumulates on the filter media which increases the resistance to gas flow. Due to this, the filter must be cleaned periodically when sufficient pressure drop occurs. During cleaning, dust that has accumulated on the bags is removed from the surface and deposited in the hopper for subsequent disposal. Depending on the type/construction of bag house, cleaning can be carried out while the bag house is on-line (filtering) or is off-line (in isolation). If gas enters into the bag house tangentially at the bottom of the casing, it gives the dust laden gas a circular motion which helps in removing the heavy and coarser particles that are present in the gas stream in a manner similar to a cyclonic collector. These collected particles are directly discharged into the hopper. It is only the very fine particles that get carried to and collected by the bags. Thus the total dust load on bags is reduced.

Bag houses are very efficient particulate collectors. They collect particles with sizes ranging from submicron to several hundred microns in diameter at efficiency of 99 percent or better. The layer of dust, called dust cake or cake, collected on the bag is primarily responsible for such high efficiency. The cake is a barrier with tortuous pores that trap particles as they travel through the cake. Typically, inlet concentrations of pollutant to bag houses are 1 to 23 grams per cubic meter (g/m3) [0.5 to 10 grains per cubic foot (gr/ft3)], but in extreme cases, inlet conditions may vary between 0.1 to more than 230 g/m3 (0.05 to more than 100 gr/ft3).Extracting hazardous dust at the point of origination and conveying them to the correctly designed filtration system is necessary to protect both personnel as well as the plant. This Dust Extractor Machine successfully captures dust with the air stream and convey it to the dust collector.

5. Assembled 3D Model:



6. DESIGN CALCULATION

Suction Capacity (Q) = $\boldsymbol{\pi \frac{D}{60} 1N}$

$$\text{Velocity of vanes (u1)} = \pi * \frac{0.120 * 2800}{60}$$

$$u1 = 17.58 \text{ m/s}$$

Now

θ =20

Velocity of air (V) = u1tanθ

V= 17.58tanθ =17.58*tan20

V=6.39 m/s

Now

$Q = \pi * v * D1 * B$

=3.14*6.39*0.120*0.05

=430.69 m^3/hr

=7.178 m^3/m

Q=240 CFM

Filtration Area

Dia of Filter Hole=100 mm

Length of Filter bag=350 mm

n=No. of hole Filtration Area

=3.14*0.100*0.350*4

=0.4396 m^2

Dust Storage Capacity

Cs=Length(l)*Width(w)*Height(h)

=285mm*275mm

=4310625 mm

7. RESULTS

It is the responsibility of the system design to ensure that there are adequate air flows and velocity in the system and that the selection of duct components and fan equipment has been optimized. Commercial dust collectors require no ductwork, saving you money on installation costs. Powered by low-HP fans, the industrial dust collectors keep your energy bills under control, and the self-cleaning units save you money on housekeeping and maintenance expenses as well. Whether you manage a large plant in the energy, aeronautics or transportation industry or you run a small welding, wood or auto repair shop, it pays to ensure that the air in your facility is free from contaminants. Protecting the quality of your product is a top priority, and an efficient dust collector, dust collector booth or media blasting equipment helps keep damaging airborne contaminants off surfaces and finishes. Our innovative dust collection systems safeguard the health of your work force and protect you from costly workers' compensation claims and lawsuits.

In this work we introduced a shaking handle which is not used in previous dust collector the use of this shaking handle is, if some dust particles can remain in the polypropylene bags so when we shake this handle all the dust particles or material in the bag will fall in to the dust bin. And these dust collectors are specially designed for cleaning welding machine. It is flexible design according to the industrial requirement we can alter the design and create for that particular requirement for the industries.

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