International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 02 | Feb-2018 www.irjet.net p-ISSN: 2395-0072

"Air Pollution Controller-Fabric Filter"

Dipti C Jagtap

Civil Engineering, Shirwal, Satara. Student of T.E. Civil Engineering, RDTC, SCSCOE, Pune, Maharashtra, India

---

Abstract: *Air pollution is a physical, chemical (e.g. particulate matter), biological agent that modifies the natural characteristics of the atmosphere. The atmosphere is a complex, dynamic natural gases system that is essential to support life on the planet earth. It has been stated that industrial unit dealing with the manufacture of explosive (various nitro compound like TNT) using concentrated nitric acid and concentrated sulphuric acid release thousands of tons of oxides of nitrogen and Sulphur into atmosphere. A fabric filters is an air pollution control device which helps to remove particulates out of gas or air released from the combustion processes. The reverse air, mechanical shaker and pulse jet fabric filters are used in number of industrial application. The fabric materials are used for bag houses are namely tissue and felt. The performance of fabric filter is depend on inlet and outlet gas temperature, opacity, pressure drop and gas velocity. Thus the fabric filters has the various application in commercial and industrial processes.*

Key Words: **Fabric filter, reverse air, pulse jet fabric filter, polluted are, compressed air cleaning, tissue, felt, opacity, pressure drop, gas velocity.**

1. INTRODUCTION:

A Fabric Filter (FF) or bag house (B/H, BH) or bag filter (BF) is an air pollution control device which helps to removes the particulates out of gas or air released from commercial processes and combustion for electricity generation, steel mills, power plants, food manufacture, pharmaceutical products and other industrial companies mostly used bag houses to control emission of air pollutants fabric filter widely used in the let 1970's after the invention of the high temperature fabric capable of withstanding temperature over 355^0F unlike electrostatic precipitator where performance may vary depending upon electrical conditions and processes functioning bag filter typically have particulate collect efficiency of 99% or more than that, even when the particle size is very small. Bag filters are used for emission reduction for many industrial applications fabric filters can be design to collect particles in micrometer range with 99.9% control efficiency. Sometimes they are used to remove particles from exhaust air stream generated by industrial processes were the clean air is recirculated back into the plant to set offset space heating needs bag houses are used incineration, power generation, cement, steel, food, chemical, metal working, pharmaceutical and carbon black industries.

Reserve air, shakers, pulse jet and fabric filters are used in a number of industrial applications. A bag filter installation consists of casing in which contains a filter medium. These filter divides the filter casing into a dirty section and clean section. In dirty section where the dust-laden air enters is the bottom section of the casing. The incoming air does not flow directly towards the filter but it pass through one or multiple dispersion plates. The main purpose of these is to create better spread across the filter so that it receives the more even load the air also losses a vast part of its kinetic energy where by per-separation takes place due to gravity the air pollutant with dust is pass through bag house and is a rid of dust particles. The dust particles is periodically remove from the filter and is collected in a tray under the filter installation (hopper).

TYPES OF FABRIC FILTER:

Bag houses are classified by the cleaning method used. The most common types of fabric filters are reverse gas, pulse jet, mechanical shaker, compressed air and ultrasonic cleaning.

A. Mechanical shaker:

Cleaning via shaking mechanism is the oldest method used these involves filter fabric being shaken back and forth. Because the fabric filter is having a high mechanical load, this method rarely apart from in very small discontinuously operating installation. In mechanical shaker bag houses tubular filter bags are fastened on to a self-plate at the bottom of the fabric filter and suspended from horizontal beams of the top. Polluted gas enters the bottom of the bag houses and passed via the filter and the dust is collected inside the surface of the bag cleaning a mechanical shaker bag houses is accomplished by the shaking the top horizontal bar from which the bags are suspended. Vibrations created by a motor driven shaft and

cam creates wave in the bag so that it shake off the dust cake. Shaker fabric filters are ranges from very small hand shaker devices to large. They can operate intermittently or continuously. Intermittent unit can be used when processes operates on a batch basis. When the batch is completed the bag house can be clean. Continuous processes use compartmentalized bag houses; when one compartment is being cleaned the air flow can be diverted to other compartment. In shaker bag houses there must be no positive pressure inside the bags during the shake cycle. Pressure as low as 0.2in.wg can interfere with cleaning. The air to cloth ratio for shaker bag houses is relatively low hence the space requirements are quite high. But because of the simplicity of the design they are popular in the minerals processing industries.

B. Reverse Air(R/A) Bag Houses:

In the reverse air bag houses the bags are fastened onto a cell plate at the bottom of the bag houses and suspended from and adjustable hanger frame at the top. Polluted gas flows normally enters the fabric filter and possess via the bag from the inside and the dust collects on the inside of the bags. Reverse air bag houses are statistically divided to allow continuous operation before a cleaning cycle is begins filtration is stopped in the compartment to be cleaned. Bags are cleaned by injecting clean air into the dust collector in a reverse direction which pressurize the compartment. The pressure makes the bag collapse partially causing the dust cake to crack and fall into the hopper below. At the end of the cleaning cycle reverse air flow is discontinued and the compartment is return to the main stream. The flow of the dirty gas helps to maintain to the shape of the bag. However to prevent the total collapse and fabric chafing during the cleaning cycle rigid rings are sewn into the bags at interval space requirement for the reverse air bag houses are comparable to those of a shaker bag houses but maintenance needs are somewhat greater clearing action gentle which lengthen bag life. It is also preferred for high temperature due to gentle cleaning action.

C. Pulse Jet Bag House (P/J):

P/J or reverse jet bag houses are used compressed streams of high pressure air to remove particulate matter during cleaning brief (0.1sec) pulses of the air are push through the bag dislodging solids which collect in the hopper below the recommended air to cloth ratio for pulse jet bag houses in between 3.25:1 and 4.0:1. Cleaning mechanism allows P/J bag houses to be cleaned while the system is online. It shows more complete cleaning than shaker or reverse air bag houses lengthening bag life. It operates at lower pressure drops and with lower space requirement but the disadvantages of pulse jet bag houses are it requires fabric for high temperature. Pulse jet bag houses are cannot tolerate high moisture level or humidity in exhaust gas.

D. Compressed Air Cleaning:

In compressed air cleaning a short compress air burst of 0.05-0.3sec is passed into a filter bag where by the filter material suddenly rises. Thus the layers of the dust found on the outside of the bag breaks and falls down into the collection try. In high pressure cleaning (4-8bar). The compressed air flows through a venture and if setup is effective it takes a huge amount of secondary air with it this secondary air is essential for effective cleaning a venture is not used at low air pressure (1-2bar). The cleaning processes can be operates via time switch or a pressure regulator. The disadvantage of fixed time period at low dust concentration is that the filter is cleaned more often than necessary.

FABRIC MATERIALS:

Fabric materials can be divided into two groups namely

1. Tissue
2. Felt

A tissue is two dimensional network and can be woven in various ways which means there is difference in permeability and pliability further the properties of tissues are affected by the characteristics of the thread or fiber, the surface treatment and the coating the filter qualities of the tissues are determined by the dust cake which builds upon the filter.

Felt use in the flue gas cleaning consist of grid support tissue into which fibers are punched due to the three dimensional networks of fiber the felt become effective for the filtration purpose due to higher mechanical strength of felt, compared to tissue, high fabric loading is possible, whereby a smaller filter installation is sufficient. The basic material for bag houses in the flue gas applications are

1. Polyacrylonitril (dralon-T)
2. Aromatic-polyamide (nomex)
3. Polytetrafluoroethylene (PTEE)
4. Glass fiber
5. Ryton (fabric material based on polyphenyl and dichlorobenzene)

All these materials have specific advantages and disadvantages related to temperature, mechanical strength, cost aspect, chemical resistance.

Filter material	Dralon-T	Nomex	PTFE	Glass fibre
Max. continuous operating temp.	130 °C	200 °C	260 °C	220 -280 °C
Moisture resistance	good	average	excellent	good
Acid resistance	good	average	excellent	good
Base resistance	average	good	excellent	average
Mechanical strength	good	good	reasonable	reasonable
Combustibility	combustible	Non combustible, decomposition above 370 °C	Non-combustible	Non-combustible
Relative price	1	2.5 – 3.5	10 - 15	4 – 6

COMPONENTS:

1. Bags, fabric and support
2. Housing and shelf
3. Collection hoppers
4. Discharge devices
5. Filter cleaning devices
6. Fan
7. Compressor
8. Timer unit

PERFORMANANCE:

Bag house performance is contingent upon inlet and outlet gas temperature, opacity pressure drop and gas velocity chemical composition, moisture, acid dew point and particle loading and size distribution of the gas stream are essential factor.

1. GAS TEMPURATURE:

   Fabrics are designed to operate within a certain range of temperature fluctuation outside of these limits even for a small period of the time. Can weaken, damage or ruin the bags.

2. PRESSSURE DROP:

   Fabric filter operate effectively within a certain pressure drop range. This spectrum is based on specific gas volumetric flow rate.

3. OPACITY:

   Opacity measures the quantity of the light scattering that occurs as result of the particles in a gas stream. Opacity is not an exact measurement of the concentration of particles. However it is good indicator of the amount of dust leaving the bag houses.

4. GAS VOLUMETRIC FLOW RATE:

   Bag houses are created to accommodate the range of gas flow. An increase in gas flow rate causes an increase in operating pressure drop and air to cloth ratio. These increases require the bag houses to work more strenuously, resulting in more frequent cleanings and high particles velocity, two factors that shorten bag life.

3. CONCLUSION

In this paper we studied about the fabric filter which is air pollution controlling device to remove the particulates out of the gas or air. The fabric filters are used in commercial as well as industrial processes. The bag houses are available in various particle sizes. The fabric filters can be design to collect particle in micrometer range with 99.9% control efficiency. The bag filters mainly used in power generation, cement, steel, food, chemical, pharmaceutical industries. There are many types of fabric filters used for industrial applications like mechanical shakers, reverse air and pulse jet fabric filters. The mechanical shaker process is the oldest method and based on mechanical work. The reverse air bag houses are fastened onto a cell plate at the bottom of the bag houses. The flow of the dirty gas helps to maintain the shape of the bag. However to prevent total collapse and fabric chafing. During the cleaning cycle rigid rings are sewn into the bag bags at interval space requirement. Pulse jet bag houses are used compressed streams of high pressure air to remove particulate matter during cleaning. In compressed air cleaning a short compressed air burst of 0.05 to 0.3sec is pass into a filter bag where by the filter materials suddenly rises. The cleaning processes can be operated via time switch or pressure regulator. The fabric materials used are mainly two type tissue and felt. The fabric filters has the main components like bags, fabric and support, housing and shelf, collection hoppers, discharge devices, filter cleaning devices, fan, compressor and timer unit. The bag house performance is mainly depend upon inlet and outlet gas temperature, opacity, pressure drop and gas velocity.

REFERENCES

1. Belba, V. H., W. T. Grubb, and R. L. Chang. 1992. The potential of pulse-jet baghouse for utility boilers. Part 1: A world-wide survey of users. Journal of the Air and Waste Management Association. 42(2):209-218.

2. Brna, T. G. and J. D. Kilgroe. 1990. The impact of particulate emissions control on the control of other MWC air emissions. Journal of the Air and Waste Management Association. 40(9).

3. Cushing, K. M., R. L. Merritt, and R. L. Chang. 1990. Operating history and current status of fabric filters in the utility industry. Journal of the Air and Waste Management Association. 40(7):1051-1058.

4. Fine particle fabric filtration. Proceedings: Symposium on the use of fabric filters for the control of submicron particulates. April 8-10, 1974. Boston, MA. Journal of the Air Pollution Control Association. 24(12):1139-1197.

5. Submicron particulates. April 8-10, 1974. Boston, MA. Journal of the Air Pollution Control Association. 24(12):1139-1197.

6. Greiner, G. P. 1993. Fabric Filter - Baghouses II. Operation, Maintenance, and Trouble Shooting (A User's Manual). Salem, VA: Valley Printers.

7. Kaplan, S. M. and K. Felsvang. 1979, April. Spray dryer absorption of SO2 from industrial boiler flue gas. Paper presented at the 86th National Meeting of the American Institute of Chemical Engineers. Houston, TX.

8. Beachler, David S.; Joseph, Jerry; Pompelia, Mick (1995). "Fabric Filter Operation Overview" (PDF). North Carolina State University. Archived from the original (PDF) on 9 November 2013. Retrieved 6 August 2013.

9. Noyes, Robert (1991). Handbook of Pollution Control Processes. Noyes Publications. ISBN 9780815512905. Retrieved 6 August 2013

10. "Filter Media Selection Chart". Air Pollution Control. Archived from the original on 9 August 2012. Retrieved 6 August 2013.

BIOGRAPHY

Dipti C Jagtap
Civil Engineering, Shirwal, Satara.
Student of T.E. Civil Engineering, RDTC, SCSCOE, Pune, Maharashtra, India