

Study and analysis of bag-house in the boiler

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Abstract

Today one of the challenge is to lower the output emission through the bag-house in the boiler, also which type of the methodology used in the bag-house which gives the lowest emission. This paper discusses about the methods of increasing the operating efficiency of bag house. This research paper describe the pulse jet type bag- house. This research paper also describe the offline and online method for the cleaning purpose. The filtration device called Electrostatic precipitator (ESP) is also discuss in the paper. Also gives the details of safety, precaution and application of the bag-house in the boiler.

Keywords: bag-house, methodology, electrostatic precipitator (ESP)

Introduction

A bag house, also known as a bag house filter, bag filter, or fabric filter is an air pollution control device and dust collector that removes particulates or gas released from commercial processes out of the air. Bag house comes into widespread use in the late 1970s after the invention of high temperature fabrics (for use in the filter media) capable of withstanding temperatures over 177 degree celcius.

Bag-house Filter Types:

There are different types of Bag Filters such as

1. Shakers
2. Reverse Air
3. Pulse Jet type (most promising one of outstanding results)

Methodology

A Pulse Jet type Bag Filter consists of a Four-sided hollow metallic body which is conical at the downside. Also, a vertical squirrel cage type arrangement is there for supporting and holding the filter bags.

These squirrel type cages are covered by filter bag material. After covering these cages with Filter Bags, it appears as a Pipe like geometry Downside of this cage is blind while the other side is open for the flue gases exit and pressurized air inlet.

During the operation of a Steam Boiler, the flue gases leaving the Boiler enters the Bag filter body. Now, these flue gases come in contact with the outer surface of the Filter bags (pipe-like). As the ID Fan creates a continuous suction effect, these flue gases try to enter the cage.

So the, bigger size dust particles get collected at the surface of the Filter and flue gases leaves Bag filter through the outlet.

Now, these dust particles which are attached to the surface of the Filter Bag are separated by the Pressurized air supplied by the Pulse Jet system installed at the top of the Bag Filter.

This pressurized air enters through the opening from where the Flue gases leave the Filter Bag and this air being pressurized hits the inner surface of the Filter Bag.

The dust particles being at rest gets separated thereby

justifying the law of inertia. These dust particles, thus separated,

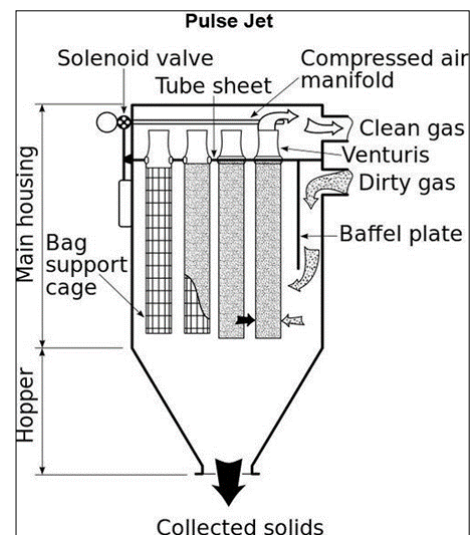


Fig 1

gets collected at the bottom bit of the Bag Filter with the help of a Rotary Air-Lock valve.



Fig 2

Online Cleaning System

High-pressure pulsed air is ejected at high speed from the pulsed electromagnetic valve through the gas pipeline from the injection hole above the center of the filter bag, passing

through the neck of the Venturi tube above the filter bag, including the induced secondary air, and rushing towards the inside of the filter bag along the A short impulse pressure wave is generated in the longitudinal direction of the filter bag, and the dust deposited on the surface of the filter bag is peeled off, and the dust falls into the ash bucket. The clean gas is evacuated through the purifying chamber. When the solenoid valve is de-energized, the pulsed solenoid valve diaphragm closes and stops the high-pressure pulsed air flow, and the end of a cleaning operation is completed.

The problem with on-line cleaning of bag filter is that high-pressure pulsed air generates high-pressure airflow in the opposite direction to the main airflow to rush the filter bag to shake the filter bag, remove the accumulated dust on the surface of the filter bag, and the dust falls into the lower part of the filter. In the ash hopper, it is discharged outside the unloading device. In this process, high-pressure pulsed air must overcome the resistance of the main air flow, and its strength must be weakened. The effective filter area of the dust collector is also instantaneously reduced (milli seconds). From an industrial point of view, the impact of this area reduction on the process system is negligible. In recent years, the bag dust collector of the Pak Hua Technology bag filter has been widely used in the rotary kiln exhaust gas treatment system.

Offline Cleaning System

The off-line cleaning of the bag filter requires that the dust collector be designed as a multi-chamber combination to achieve chamber-by-room cleaning. When a filter room needs cleaning, the filter room is isolated from the main air flow. The filter room is isolated by setting the inlet or outlet valve is implemented. This process is maintained for about 2 to 3 minutes. As a result, the total filter area (or called the gross filter area) of the precipitator during each cleaning operation is reduced by the area of the filter cloth in one chamber, and the reduction in the total filtration area also results in an effective filtration area (or net filtration area). Obviously it is uneconomical and increases infrastructure investment, which is inconsistent with the wishes of the owners. In this respect, it is not as good as a bag filter to remove ash online. However, the isolation of the filter bag from the main airstream to clean the filter bag has technically many advantages:

1. The amount of high-pressure pulsed air passing through the filter bag does not have to be large to effectively remove dust and the required pressure is low.
2. The dust from the surface of the filter bag has enough time to fall into the ash bucket, and the chance of re-flying is very small.
3. The frequency of cleaning decreased and the life of the filter bag was extended.
4. The number of pulse solenoid valves is less, which can reduce the investment and maintenance workload once.
5. The amount of compressed air required for refined ash is less, which saves energy.
6. The dust removal efficiency is high and the dust collector can maintain a low pressure drop. As a result, the operating cost of the dust removal system is reduced.

The above-mentioned advantages of the pulse-jet bag filter due to off-line cleaning of the bag filter are proven to be correct by practice. Therefore, it can be fully applied in the

rotary kiln exhaust gas treatment system.

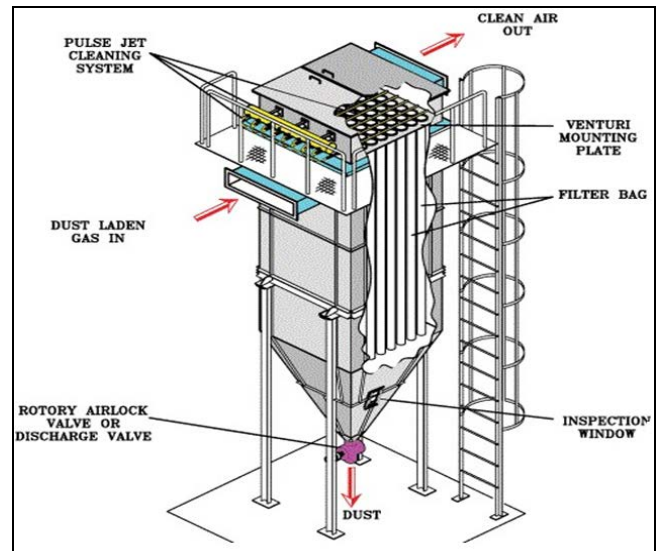


Fig 3

Increasing the Efficiency of Baghouse

Here are three small tweaks for your pulse jet dust collection system to increase operating efficiency without a major overhaul or great expense.

1. Ensure Filter Bags Are Installed Correctly
2. Install a Clean-On-Demand System
3. Integrate All System Controls (Clean-on-Demand, timer boards, manometers, etc.)

Correctly install filter bags

Filter Bags are the heart and soul of a bag house. If they are not installed correctly the entire system will suffer, efficiency will go down, filters will fail prematurely, system downtime will ensue and affect the entire process. Check that filters with flanges and cuff are folded over and smooth and not wrinkled around the cage to prevent leakage, and premature failure due to bag abrasion. Bottom-loading filters should be installed with seams 180° from the cage collar gap.

Additionally, there are several specific issues to watch out for depending on the exact design of filter bags being used. For snap band construction, check that the seams are set properly in the tube sheet. This can be done running your fingers along the edge of each bag during installation/maintenance checking that each one is smooth, with no wrinkles, gaps, or binds in the snap band. For designs with gaskets or rubber o-rings make sure these are not pinched by the clamps in a way that will allow leaks, or cause accelerated wear.

Additionally, with all bag types, all seams should be at a 45° angle from the aisle to minimize fraying due to increased can velocity, all clamps should be set 90° from the seams, and all filters need to be set properly in the cage grooves.*

*Additional Tip: Have everything as uniform (clamps, seams, etc. all set in the same direction) as possible to make it easier to diagnose and remedy problems.

Clean-on-demand system

Manually having a technician initiate the cleaning cycle for your dust collection systems can consume a large amount of time, and lead to less than desirable results such as over/under cleaning, operating at higher differential pressure

(raising system resistance, and fan load), and lower collection efficiency. Simplify the process and remove the need to be a industrial filtration expert out of the equation by installing a clean-on-demand system.

Using a clean-on-demand timer board for your baghouse will simplify the cleaning process, and result in more effective cleaning of your dust collection system.

These systems are comprised of a differential pressure gauge, and a control board. The DP gauge monitors the difference in pressure between the clean-air and dirty-air sections of the bag house (thus giving you the pressure drop over the filters at any given time). DP gauge is connected to the control board, which has a high and low pressure setting which serve as the start and stop markers for the system.

When the DP in the bag house rises past your high setting (indicating the bags need to be cleaned), the controller starts the pulse-jet cleaning cycle, once the pressure reaches the preset low, the pulse-jet system is disengaged.

For a relatively small capital investment clean-on-demand systems can dramatically improve your system efficiency by ensuring the minimum amount of cleaning cycles necessary are initiated, which in turn leads to lower compressed air usage, lower operating differential pressures, and less filter wear. These benefits will lower system operating maintenance costs, while seeing improvement in collection efficiency, and extended filter bag life.

Integrate dust collection system controls

Maintaining the correct amount of dust cake on your filters is essential to achieve the maximum collection potential of your filter bags. In fact it is the dust cake itself that does the filtering in a bag house, not the filter bags! * When the pulse-jet cleaning system engages, it removes the excess dust from the filter surface. Essentially what this does is rearrange the dust cake on the filters, removing a portion of it, and leaving behind the minimum amount needed to reform the dust cake for optimum efficiency. When cleaning cycles are carried out, if each row is pulsed one after another in sequential order, high internal air velocities between the filters (can velocity) can cause the recently dislodged dust to be redeposited on the recently cleaned bags in the previous rows. Since the dust is carried at higher than normal velocities, it can penetrate the fabric (instead of settling on top and forming part of the dust cake) and embed itself therein. This will eventually lead to filter blinding, and a reduction of filter service life.

Installing a sequential controller can help you avoid this problem. This device controls the order in which the bags are cleaned, staggering the cleaning pulse pattern between non-adjacent rows. For example, in a bag house with 10 rows of bags, you can set the cleaning pattern to first clean rows 1,4,7,10 then 2,5,8, and finally, 3,6,9. You can also set the controller to only fire when the pressure in the compressed air header is at full, providing a consistent pulse force that will properly clean the bags every time.

Additionally, to further promote longer filter life, see that each pulse duration is set as short as possible, generally around 0.1 sec.

If you do not currently have a DP clean-on-demand system, an alternative is to use a timer control to regulate system cleaning. When using a timer board setup, it is vital to set the intervals to match your system parameters, ensuring that the filters are neither over, or under cleaned. Maintaining a sufficient level of dust cake is vital to achieving a high

system efficiency.

Finally, it is possible to integrate all of these different systems into one unified control panel for operator convenience. You can have all of your controllers relayed to a central LED controller, which then is connected to an external PLC controller or computer for remote monitoring, and recording of all system activity. From here it is then possible to configure all control parameters e.g. timer settings, clean-on-demand DP points, pulse-jet firing order, etc. Additionally, having all operating data in one convenient location will allow for quickly pinpointing problems before they become major issues.

Preceptor Comparison Between Bag house and Electrostatic Operation

Bag filter: stable operation, simple control, no high-voltage equipment, good security, and boiler operation with close, strict management requirements.

Electrostatic precipitator: interference in the operation of many factors, the control is relatively complex, high-voltage equipment, high-security requirements. Boiler operation requirements are not high, but strict equipment management requirements.

Downtime and start

Bag filter: convenient, long-term outage need to do a good job of protecting the bag.

Electrostatic precipitator: convenient, can be shut down at any time.

Inspection and maintenance

Bag filter: maintenance workload is small, can achieve a non-stop test, three or four years to replace the filter bag workload is relatively heavy.

Electrostatic precipitator: maintenance workload is relatively large, the test must stop.

Equipment investment

For the conventional flue gas conditions and dust (mainly refers to the electrostatic precipitator more suitable for flue gas), the two dust collector discharge concentration to achieve the current low environmental requirements: the initial investment bag dust collector than electrostatic precipitator about 20 ~ 40% or so.

For low sulfur high specific resistance dust, high SiO₂, Al₂O₃ class is not suitable for electrostatic precipitator dust collection, two kinds of dusts to achieve the current lower environmental requirements (200mg / Nm³): the initial investment electrostatic precipitator and bag Large dust collector or electrostatic precipitator investment is high. For typical coal types, such as the Zhungeer coalfield and sea wave bend coalfield, electrostatic precipitator investment is higher than the bag filter.

Safety

1. Wear PPEs (PERSONAL PROTECTIVE EQUIPMENT) compulsory.
2. Follow manufacturer recommendations about safety. Never
3. Place yourself or any other person in path of an ash flow.
4. Wear mask while handling ash.

5. Only authority person allow to enter into hopper in case of any problem.
6. Never touch rotating elements.

Application

The bag house is used in the Cement industry. Also it is used in the steel industry and used in all type of thermal power plant.

Conclusion

Thus, by increasing efficiency of the bag house we have lowered the emmision of the bag house of boiler. And also studied the methodology of the baghouse in the boiler. The Efficiency of pulse jet bag house is increased. Also the Online & offline cleaning system is diffrentiated.

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