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THE TECHNOLOGY DEVELOPMENT OF THE COEBP

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ABSTRACT

COEBP stands for Compact Electrostatic Baghouse Precipitator. This document tells about the principle of the COEBP and technology development in its application in power industry. This new dedusting method combines the dust-collecting advantages of traditional dedusting – electrostatic and baghouse dedusting. A large quantity of mill dust is first collected by pre-electrostatic field, and then fine mill dust is collected via backstage baghouse dedusting, and hence, realizing the conception of organic combination of electrostatic and baghouse dedusting. It is important originality and a technology development in dedusting principle and method.

1. FOREWORD

With fast economic development and improvement of people's living standard increasingly, the state imposes tougher requirement on air quality control and on the performance and reliability of the dedusting equipment. As two kinds of the most important traditional dedusting equipment for purifying industrial fume, the electrostatic and the baghouse duster have played a leading role in the past industrial mill dust reduction and control. However, under the new situation, they have insufficiencies which cannot be compensated for by themselves. With unique conception as described in this document, the COEBP gives full play to the advantages of the electrostatic and the baghouse duster and overcomes their shortcomings. And therefore, this kind of dedusting method improves the combination performance of the whole machine greatly, and the COEBP becomes a new type of high-reliable and high-efficient duster which meets the new emission standard requirements.

2. ISSUES WHICH THE CONVENTIONAL ELECTROSTATIC PRECIPITATOR FACES

The electrostatic precipitator utilizes strong electric field corona to ionize the fume and to charge the mill dust. With effect of the electrostatic field force, the mill dust is separated from the fume. Its characteristics are as follows:

(1) The electrostatic precipitator body has little pressure losses, generally less than 300Pa.

(2) The electrostatic precipitator can process the industrial fume on a large scale.

(3) It is resistant to high temperatures and may run below 400? .

(4) The main parts have long service life and are easy to maintain.

However, the main shortcomings of the electrostatic precipitator are that the dedusting performance is subject to influences of the mill dust physical and chemical characteristics, and that the electrostatic precipitator is not so effective as collecting the high-ratio resistance mill dust, fine mill dust and high-viscosity mill dust. Wide-range increase of dust-collecting area to improve the dedusting efficiency results in uneconomical investment, and under some special work conditions, the electrostatic precipitator cannot be used normally.

3. INSUFFICIENCIES OF CONVENTIONAL BAGHOUSE DUSTER

Also called filter-type duster, the baghouse duster uses baghouse filter elements which are made of fibrous braided fabric to collect the solid particulate matter in the dusty gas. Its features are as follows:

(1)It has high dedusting efficiency; the outlet emission is stable; it is easy to realize emission equal to or less than 30mg/Nm^3.

(2)The dedusting efficiency is not subject to influences of the mill dust characteristics.

(3) Collection of fine mill dust (with PM10 of the grain size) may be improved and resolved by filter technology.

(4) To some extent, it also has an effect on collecting the harmful gas such as Dioxin and SO_2.

But the baghouse duster has the following insufficiencies:

(1) High resisting force for operating. Generally it is 1500-2000Pa, which causes high resisting force for the system. The draught fan at the back of the duster has high power, which results in high operating cost.

(2) Limited service life of the filter bag. It takes much money to replace the filter bag and the workload is heavy.

(3) The chemical fiber filter bag is unable to bear the passing of the high temperature fume. In addition, it imposes strict requirement on water and oil content in the fume.

4. CONCEPTION OF LONGKING COEBP

4.1 Proposal

Fujian LongKing Co., Ltd. (shortened as LongKing) has devoted itself to the research in and development of the dedusting technology for a long time. Earlier in mid nineties, the writer of this document summarized the knowledge from long-term practice and thinking and proposed the conception that the advantages of the electrostatic precipitator and the baghouse duster would be incorporated into the integrated COEBP:

(1) The strong points of the electrostatic precipitator are utilized to the maximum extent by making full use of the characteristics, that is, fit for processing large sum of fume and large absolute amount of the collected dust by the first electrostatic field. The electrostatic field is arranged in the new type of pre-duster.

(2) After a great deal of mill dust is collected by pre-electrostatic field, high-efficient intercepted baghouse duster is used at backstage. At this time, the mill dust load of the filter bag is reduced greatly; the resisting force is decreased; the de-ashing period is extended. The shortcomings of the baghouse duster are compensated, while advantages of the baghouse dedusting are utilized, such as high efficiency and lower requirement on the mill dust characteristics.

(3) The arrangement method and floor area of the new duster should be similar to those of conventional dedusting method, and the equipment cost performance should be increased.

(4) The performance indices of the new duster such as dedusting efficiency have clear superiority, and this kind of duster is guaranteed to run long in a stable and high efficient way. Besides, there is little workload for overhauling and maintenance with low operating cost.

4.2 Principle of the COEBP

(1) The electrostatic field collects 80-90% of the total mill dust, while the baghouse duster collects the remaining 10-20%.

(2) Effects of the charged mill dust in the fume

a. Diffusion effect: The mill dust with the same electric charge is mutually exclusive and diffuses quickly at backstage, forming the gasoloid suspension state in evenly distribution. Therefore, the concentration in all rooms of the backstage bag is uniform and the flow rate is equal.

b. Absorption and exclusion effect: The mill dust with charges of different polarity absorbs each other to produce electric coagulation which coagulates and incorporates the fine-particle mill dust into big particle mill dust for easy collecting. And the mill dust with charges of same polarity excludes each other, and so the mill dust particle which deposits on the filter bag surface is in order. The formed mill dust layer has strong air permeability with high porosity and desquamation.

4.3 Application and practice

After putting forward the idea and conception of the COEBP, LongKing has enriched and improved this idea and the technical solution. In 2002 Longjing took the lead to launch the first COEBP and put it into industrial test run in a cement mill successfully. After that the second such duster was brought into use in the cement industry. In 2004 LongKing applied this kind of new duster in the boiler dedusting modification project in a power station, which became a breakthrough in electric power industry. This technology has extended in the application and practice field.

5. BREAKTHROUGH OF LONGKING COEBP IN ELECTRIC POWER INDUSTRY

5.1 The major application technology issues which should be resolved in the electric power industry

How to select long-service-life filter material according to the characteristics of the fume work conditions.

How to avoid oil sticking on the filter bag as per the boiler ignition and fuel oil work condition

How to resolve the issue concerned with the electrostatic field structure and high-voltage electricity control so as to ensure high-efficient operation of the pre-electric field in accordance with the power plant running characteristics

How to solve the issue related to the gas path connection and air flow distribution between the electrostatic field and the baghouse

How to settle the issue on the filter bag resisting force control when the fume work condition varies as the combustion coal changes

How to protect the filter bag when various abnormal failures take place in the boiler

5.2 Examples of typical projects application

5.2.1 Background of works

50MW unit modification works in a domestic power plant. The engineering parameters are as follows:

(1) Boiler type: circulating fluidized bed

(2) Maximum continuous evaporation capacity of the boiler: 240t/h

(3) Maximum coal consumption quantity: 32.18t/h

(4) Air preheater type: horizontal-type, and heat tube-type at final stage

(5) Original duster: single-cell three-field electrostatic precipitator

(6) Duster modification target: equal to or less than 30mg/Nm^3

In order to meet the emission requirements, decrease the modification time and reduce investment, the owner decides to adopt LongKing COEBP after various proofs.

5.2.2 Modification scheme

(1) Reserving the original electrostatic precipitator's inlet nozzle and the first electrostatic field, steel bracket, ash bucket, shell, insulation, etc.

(2) As to the first original electrostatic field, the shell and positive plate are cleaned; the polar curve of the first electrostatic field is replaced, with pole span rectified and adjusted. Complete overhauling is conducted to the shaker and the electrostatic field.

(3) The negative and positive pole system of the original back secondary and third electric fields are removed and baghouse dedusting is applied. A guide device is installed to ensure gas distribution when the fume flows through the bag.

(4) Cooling via water spraying is used to protect the filter bag.

(5) A pre-parging device is established.

5.2.3 Performance parameters the COEBP

Processing fume amount: 460000m^3/ h

Fume temperature: 140?

Entry concentration: 23.94g/Nm^3

Exit concentration: equal to or less than 30mg / Nm^3

Entry and exit resisting force: equal to or less than 1200Pa

(1) Partial technical parameters at pre- electrostatic field (with the first original electrostatic field reserved)

Total circulation area: 101.2 m^2

Number of electrostatic fields: one

Effective width of single electrostatic field: 9.2m

Effective length of electrostatic field: 3.75m

Total dust-collecting area: 1898 m^2

Negative and positive pole plate type: C-type plate + barb wire

(2) Technical parameters of backstage baghouse dedusting

Total filter area: 6221m^2

Filter specification: F160x7000mm

Total number of filter bags: 1768

Filter bag material: tectorial membrane PPS

(3) Exit fume emission concentration and guarantee value of the COEBP: equal to or less than 30mg/ Nm^3

5.2.4 Effects of the COEBP running

The COEBP was put into test run and debugging before the Spring Festival of 2005, and since then it has endured the repeated tests of boiler ignition for many times and continuous long fuel burning. No clear stain was found in the filter bag. Since the unit was brought into operation officially in May 2005, the running parameters of the COEBP have been in stable condition, and the resisting force is within the design value.

The dedusting efficiency satisfies all. The power consumption in the whole dedusting system is lower than that of conventional baghouse duster. The combination performance shows that this kind of new dedusting equipment has unique features and application value, and in particular it has obvious advantages in modification and efficiency improvement.

6. PROSPECT OF APPLYING THE COEBP

As an environmental energy-efficient product for a new generation, the COEBP exhibits its strong vitality in improving the dedusting efficiency and in controlling fine-particle mill dust effectively. With increasingly high requirement for environmental protection and enhanced control of fine particles, the dedusting efficiency need be improved for the electrostatic precipitator of the newly approved project and for those in operation, so as to lower the emission. Compared with increasing the electrostatic precipitator capacity or modifying a duster into a baghouse duster, the COEBP dedusting technology is more reliable in technology and better in economy. Using the COEBP dedusting technology has technical and economic advantages, especially for high-ratio resistance (larger than10^{12}O·cm) mill dust, mill dust with low sulfur and coal, and after the desulfurating fume mill dust.

7. CONCLUSION

The COEBP is a kind of new high-efficient and high-reliable duster, which combines the two mature technologies of the electrostatic precipitator and the baghouse duster organically. By drawing others' strong points, the advantages of the

electrostatic precipitator dedusting are fully utilized, such as collecting a great deal of dust in the first electrostatic field, lack of sensitivity to the mill dust granularity and specific resistance by the baghouse dedusting, and low emission concentration. It is a new generation of dedusting equipment which meets the stricter emission standard. It may be applied in industries such as the electric power, construction material, metallurgy, and it has more advantages especially for efficiency improvement and modification of old-type electrostatic precipitator(basically with the original location reserved, the emission concentration is less than 50mg/Nm^3).Successful development of this product is another important breakthrough in the dedusting technology of our country.