A Discussion on the ESP-FF Hybrid Precipitator

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Abstract: This article introduced several concerned questions when people choose the ESP-FF hybrid precipitator and compared the performance characteristics and applicability of integral and detachable ESP-FF hybrid precipitator.

Keywords: ESP-FF hybrid precipitator, Fabric filter

1 INTRODUCTION

Electrostatic precipitator can collect large amount of dust efficiently. It has been widely used in the world. But with the stricter environmental emission standard, electrostatic precipitator cannot meet the standard in many working conditions. Collecting efficiency of ESP will be affected and could not reach the standard of discharge when the type of coal has been changed and resistively of fly ash is high. The ESP-FF hybrid precipitator was first exploited and used in industry in the United States 20 years ago, and in recent years it has been further developed and applied in China. Based on the experience of our company, the article discussed several technological application problems when selecting and designing the ESP-FF hybrid precipitator.

2 THE TYPE OF ESP-FF HYBRID PRECIPITATOR

ESP-FF hybrid precipitator has several types; many projects are chosen the type of Compact Hybrid Particulate Collector (COHPAC). COHPAC can be divided into separate type and integrative type base on the way of combination, both have advantage and disadvantage.

There is no flue inside of the integral ESP-FF hybrid precipitator, the fabric filter is contacted the electrostatic precipitator direct and there is no room among various filtrate chambers. Operate resistance of the equipment is lower with the small flow resistance of dust. At the same time, there is no rear seal and other facilities such as flue and import air door in electrostatic precipitator, so the equipment needs little investment and small floor space. But just for the direct link; it is impossible to examine each room on-line. In additional, the fabric filter will still be influenced in the high fume temperature ,though we can protect fabric filter by closing the air washer room‘s air door and opening the bypass air door.

The detachable ESP-FF hybrid precipitator is a combination of an independent electrostatic precipitator and fabric filter. In the detachable ESP-FF hybrid precipitator, the flue, the import and export air door and other facilities all be set. The fabric filter can keep any filtrate chamber from the flue gas by closing the import and export filter throttle, so routine maintenance is much more convenient. In case of emergency, we can close import and export filter room air door, it keeps the fabric filter away from fume and protects the fabric filter well. At the same time there is no interference between fabric filter and electrostatic precipitator, and the airflow distribute more reasonable. But the detachable ESP-FF hybrid precipitator covers large areas and the resistance is higher.

According to the technical characteristics of these two types, the integral ESP-FF hybrid precipitator is suitable for new project while the detachable ESP-FF hybrid precipitator is suitable for the project that electrostatic precipitator need to be transformed to ESP-FF hybrid precipitator. It is the detachable ESP-FF hybrid precipitator with 6*600MW in India while it is the integral ESP-FF hybrid precipitator with 200 MW in Baotou city which is a rebuild program we carried on.

3 THE RESISTANCE OF ESP-FF HYBRID PRECIPITATOR

The resistance of ESP-FF hybrid precipitator and fabric filter has the same trend. The resistance is lower at the early operating. And resistance of dust collecting adds along with the increase of residual resistance. According to the present situation the greatest resistance of the detachable ESP-FF hybrid precipitator is 1200 Pa-1400 Pa in his lifetime, and

It is lower about 200 Pa than the integral ESP-FF hybrid precipitator.

The investment and operational cost of the integral and detachable ESP-FF hybrid precipitator are listed in Table 1 (a) case study of ESP-FF hybrid precipitator (amount of fume is 2,000,000 m^3/h) with 300 MW.

Table 1 (a) The investment and operational cost of ESP-FF hybrid precipitator

Item	The integral ESP-FF hybrid precipitator (two electric fields)	The detachable ESP-FF hybrid precipitator (two electric fields)
Collection efficiency	No matter what type of coal changes, The concentration of smoke dust emissions can be less than 50	

	mg/Nm^3. By choosing a suitable filter to ensure that smoke dust emissions less than 30 mg/Nm^3.	
Maintenance of equipment	One of the fume must be cut when overhauled	Checked on-line at the 100% pressure
Equipment's ultimate resistance	1200 Pa (pressure different between import and export flange)	1400 Pa (pressure different between import and export flange)
Equipment's average resistance	900 Pa	1100 Pa

Table 1 (b) The investment and operational cost of ESP-FF hybrid precipitator

Item	The integral ESP-FF hybrid precipitator (two electric fields)	The detachable ESP-FF hybrid precipitator (two electric fields)
Equipment electricity consumption	Induced draft power consumption of fan is about 590 kW because of resistance of equipment (Calculated with 900pa) Equipment power dissipation is about 750 kw (include electrostatic power dissipation of precipitator which is about 700 kW) Total: 1340 kW.	Induced draft power consumption of fan is about 720 kW because of equipment (Calculated with 1100 Pa) Equipment power dissipation is about 750 kw (include electrostatic power dissipation of precipitator which is about 700 kW) Total: 1470 kW.
Equipment operation and maintenance cost (calculated with the equipment run 7500 h per year and plant electric consumption is 0.14 Yuan/kWH)	Mainly includes: 6) Cost of Filter replacement. The cycle lifetime of filter is 4 years, each year need 1.1 million Yuan. 7) Cost of Cage frame replacement. The Lifetime cycle is10 years, its need 90,000 Yuan each year. 8) The polar line and plate need to be replaced every ten years, their need 110,000 Yuan each year. 9) Routine maintenance costs about 20,000 Yuan each year. 10) Electric cost is 1.41 million Yuan. Total cost: 2.73 million Yuan	Mainly includes: 1) Filter replacement cost. The lifetime cycle of filter is 4 years, each year need 1.1 million Yuan in average. 2) Cost of Cage frame replacement. Its lifetime cycle is10 years, its need 90,000 Yuan each year. 3) Calculated with plate and polar line replacement every ten years, they need 110,000 Yuan each year. 4) Routine maintenance costs about 20,000 Yuan each year. 5) Electric cost is 1.54 million Yuan Total cost: 2.86 million Yuan
Operation management	More difficult	More easy
Equipment investment	About 18.5 million Yuan	About 19.5 million Yuan

4 THE LIFE CYCLE OF ESP-FF HYBRID PRECIPITATOR

According to the service condition of fabric filter in China, the normally service life of fabric filter is 3 to 4 years. The electric field in front of the fabric filter has captured about 90 percent of the dust and reduced the abrasion of fabric filter. At the same time as the load of fabric filter reduced greatly, cleaning frequency was also reduced and bag's fatigue damage is slow down. In addition, the impact of intensity is lower when the bags run in a relatively low pressure condition. So the normal service life of ESP-FF hybrid precipitator should be longer than the general fabric filter and its life cycle can prolong to four years.

5 THE TYPE SELECTION OF TECHNICAL PARAMETERS OF ESP-FF HYBRID PRECIPITATOR

In our view, two Electric fields are suitable for ESP-FF hybrid precipitator. Although one electric field is very economic, the reliability is not enough. For example, when ash conveying system and other parts of ESP-FF hybrid precipitator went wrong, electric field will be short-circuit and pre-dust function of electrostatic precipitator will be lost, the load resistance of dust collector increase with the load of fabric filter. It is quite waste of two more electric fields for the lower increased of the amount of dust.

The length of each electric field can be designed about three meters. The velocity of fume can be higher than the general electrostatic precipitator in electric field, because dust secondary flying problem can be ignored in ESP-FF hybrid precipitator. At present, ESP-FF hybrid precipitator mainly used for high-resistance and other coal types which dust be difficult to collect , and electrostatic precipitator's operation parameters are not too high ,so the parameter of power can be set lower, and the homopolarity distance of more than 400 also can be used. The concentration of dust in fabric filter of ESP-FF hybrid precipitator is just 10 to 20 percent of the fabric filter, the interval time of dust cleaning is 4 to 8 times longer than the fabric filter, and filtering wind speed can be set at 1.2 m^3/m^2/min-1.4 m^3/m^2/min.

6 CONCLUSIONS

ESP-FF hybrid precipitator is a kind of highly efficient dust collecting equipment. There are different characteristics and adaptability in ESP-FF hybrid precipitator、electrostatic

precipitator and fabric filter. The integral ESP-FF hybrid precipitator is suitable for new projects, and the detachable ESP-FF hybrid precipitator is suitable for the transformation project. Though equipment and operation cost of the integral ESP-FF hybrid precipitator is little higher than the detachable ESP-FF hybrid precipitator, the maintenance of integral ESP-FF hybrid precipitator is more convenient and it can protect the fabric filter better.