Coal-fired Utility Boiler Operation Factors Analysis and Optimization Measures

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Abstract. Factors affecting the operation of boiler safety, economy and environment is complex, involving the furnace combustion process optimization adjustment, slagging in the furnace, dust, corrosion and wear, such as process, and the flue gas temperature deviation, temperature deviation, and the coal pulverizing system and other auxiliary system safe and economic operation, etc, coal blending technology and low pollution technology is also closely related to the operation.These factors relate to each other and influence each other, for these reasons, in large changes in the coal boiler, combustion equipment, boiler overhaul after reform and new unit test for boiler combustion system optimization and adjustment after the production, in order to master the operation of the boiler under various load characteristics, so as to achieve economic, security, environmental protection operation of boiler coordinate with each other.

1. Introduction

Most of China's coal-fired power plants with coal as the main fuel, due to the change of coal in the boiler in the actual operation is more frequent, directly affects the efficiency of boiler operation, safety and environmental performance.Existing for coal and coal blending system has many shortcomings, power plant boiler burning coal quality is difficult to secure, at the same time as the supercritical and ultra supercritical units gradually put into operation, running of boiler combustion optimization put forward higher request, therefore the boiler operation optimization adjustment has become improve the boiler efficiency, safety, environmental protection one of the key technology of unit performance and utilization [1].

2. The Main Factors Affecting the Operation of Coal-fired Boiler

There are many factors will affect efficiency of coal-fired boiler operation, and between each factor and cross each other.In the process of the operation of the coal-fired boiler has some main factors on its running state played an important role, as long as can catch the main factors to the existing coal-fired boiler running performance effectively improve and enhance.In this paper, the operation of the coal-fired boiler influence factors can be divided into three parts: coal-fired boiler structural design is unreasonable, unreasonable operation parameters change and external factors.

2.1. *Coal-fired Boiler Structural Design Is Unreasonable*

Coal-fired boiler in the process of operation, its itself the rationality of structure design will directly affect the utilization of energy.This is due to the energy distribution and the absorption of coal-fired boiler heating surface in the bore and the combustion performance, will be affected by its own design.Unscientific boiler design can cause furnace internal distribution of the heating surface, appeared the situation of local hot or too cold, not only cannot achieve the purpose of energy conservation and emissions reduction, will even cause serious influence the safety of the operation of coal-fired boiler.

2.2. *Unreasonable Operation Parameters Change*

The change of operation parameters is not reasonable or unreasonable operation can also lead to serious problems, this needs to adjust the operation of coal-fired boiler.Run the economy will be affected by changes in some parameters of boiler, including the condenser vacuum, main steam pressure, etc.The parameters of the power plant to find the most economical adjustment scheme, to adjust the parameters of the coal fired boiler.If coal-fired boiler in the process of running fault will cause the unreasonable change of parameters, reduce the running performance of the unit, or some running problems [2].Often occurs in the production process of power plant boiler fouling problems, according to the survey, the scale of each mm must be from 3% to 10% of the waste of fuel.So most of the power plant will take measures to descaling processing, the main approach is the dosing process, using the corresponding antiscale agent to prevent fouling.

2.3. *External Factors*

There are also some external factors to cause a decline in the performance of coal-fired boiler operation, for example, using coal quality is too low.Appear this situation will not only make in operation of the boiler heat loss increases, and exacerbate the slagging pipe scale, even cause corrosion to the pipelines.

These factors are not isolated, but influence each other, and cross each other, in order to further improve the performance of the coal-fired boiler, should be to comprehensive consideration of these factors, to avoid the failure in the process of operation, to ensure the economy and safety of coal-fired boiler.

3. The Performance of Coal-fired Boiler Optimization Method

To optimize the performance of coal-fired boiler, the parameters should seize the main contradiction, take targeted measures to deal with these factors.This article mainly from reducing boiler heat loss and reduce the influence of parameter change two aspects to optimize the performance of coal-fired boiler.

3.1. *Reduce the Heat Loss of Coal-fired Boiler*

Coal-fired boiler heat balance which is the input heat boiler, including the heat loss and the effective utilization of heat, boiler fuel consumption, heat efficiency, the heat loss, efficient use of both can be reflected by the balance, so can run through heat balance to the rear of coal-fired boiler level and design quality inspection.Through the analysis of heat balance to find out the main heat loss, and to analyze the causes of the problem of heat loss, in order to improve the running efficiency of coal-fired boiler.So-called coal-fired boiler heat output is also in the whole fuel heat input, the percentage of the steam and water absorption of heat, so also known as the boiler efficiency or the boiler thermal efficiency.Boiler heat loss was part of the boiler heat balance minus the effective utilization, boiler heat loss mainly includes the following several parts: ash physical heat loss, heat loss, solid incomplete combustion heat loss, incomplete combustion heat loss of gas and smoke exhaust heat loss.

Boiler heat balance efficiency will be affected by this synthesis of several heat loss, in order to further improve thermal efficiency of boiler, must find out the influence of the weighting factor.In the process of practice, the author found that the heat loss of recyclable energy is the biggest boiler exhaust heat loss.This is due to the boiler has high exhaust temperature, generally not less than 125 ℃

[3].Through the chimney this heat can be directly discharged into the atmosphere, causing the waste heat.If able to exhaust smoke temperature is reduced, can save a part of heat loss, but it also can make the corrosion of heat exchanger at the end.The common practice of current of each power plant is the low pressure economizer installed after desulphurization device, through the condensate recovery of waste heat of flue gas.It also leads to the low pressure economizer must face the operation condition of corrosion.

Part produces in the process of combustion of combustible gases, such as CH_4, H_2, CO, etc, these gases without complete combustion emissions into the atmosphere, causing the loss of heat.Smoke of excess air coefficient and CO content has a decisive role on the loss.If you have larger excess air coefficient, the combustible gas can get sufficient combustion, thus reducing discharge amount of combustible gas in gas. But if excess air coefficient is too large, will reduce the adiabatic combustion temperature, so that the combustion efficiency is lower, so you should choose reasonable excess air coefficient.The combustion efficiency and power of the coal mill will affect solid incomplete combustion heat loss, therefore wants to be coordinated to the combustion efficiency and capacity of the coal mill.

3.2. *Adjust and Monitor Boiler Operation*

Adjustment of boiler operation is to ensure the evaporation capacity of the boiler, and steam temperature, pressure and quality, based on the requirement of the user according to provide the superheated steam to the turbine.In the process of adjusting and monitoring the boiler load must pay attention to the outside world on the basis of the need to adjust evaporation, safeguard the normal water level of the drum, and carries on the equilibrium water supply.The boiler superheated steam temperature and pressure in a reasonable range, guarantee the quality of the steam and water [4].

Reasonable adjustment of the operation of boiler, first, to adjust amount of pulverized coal, the burner in only a few and adjustments to powder machine speed.Secondly, to adjust volume, make it adapt to send charging in the amount of fuel, so have to adjust the ventilation, to adjust excess air coefficient, thus to change of combustion state, for the whole operation process is optimized, thereby to reduce heat loss in the process of operation.

4. Conclusion

Under the background of our country economy the new normal, power plant energy conservation and emissions reduction increasingly attention.And the boiler operation efficiency directly affect the unit operation economy, affect the cost of power generation.Reasonable adjustment parameters and transform boiler heating surface of boiler operation can realize saving energy and recycling, achieve energy conservation and emissions reduction, in line with the requirements of sustainable development strategy.This article from the perspective of boiler efficiency promotion, analyzes some main factors influencing the running efficiency, and then from the boiler operation parameters effect the performance of the unit operation and boiler heating surface heat loss was analyzed two improving boiler operation methods and way to realize energy conservation and emissions reduction in performance.Through boiler operation adjustment, ensure the boiler to produce steam pressure, temperature and steam quality, ensure the boiler steam evaporation capacity and timely supply of the superheated steam turbine need, ensure the safety and economy of boiler unit.

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