Analyzing the temperature control of steam purging of 660mw ultra-supercritical once-through boiler with pressure-reducing method

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Abstract. This paper generally introduced the process of steam purging of the ultra-supercritical once-through boiler of Jiangxi Xinchang 2×660MW Power Plant with the pressure-reducing method. In this paper, the key-points of steam temperature control was importantly analyzed and summarized. The success experience can provide the reference for preventing steam overtemp of the similar ultra-supercritical once-through boilers with pressure-reducing method.

1. Introduction

The method of reducing the pressure of the blowing pipe is much smaller than that of the voltage regulating method[1]，only a set of boiler pulverizing system and turbine pump system was put into operation, can meet the construction unit capacity of water shortage, the installation period and equipment arrival late tight voltage method is difficult to overcome, so boiler 600MW and above most capacity using depressurization blowpipe.

But during the intermittent pressure boiler steam water system piping and pipe system temporary pipeline working condition is bad, easy to produce metal thermal fatigue damage should be at this time, prevent the main steam temperature is very important, relates to the torch during the equipment and personal safety, usually a blowpipe depressurization time is short, generally not more than 120s, and reducing the temperature electric door switch once the most time exceeds 60s, the water control of main steam temperature effect is not obvious, to control the main steam temperature through other reasonable and effective manner does not exceed the allowable range.

The 2 x 660 MW ultra super critical boiler start-up debugging stage flameout depressurization pipe combined with the new project of Jiangxi Xinchang power plant, some key factors of steam temperature effect were analyzed and summarized to prevent a similar ultra super critical boiler intermittent pressure steam temperature appears to provide some reference over temperature.

2. Equipment Overview

Jiangxi Xinchang power plant "large pressure small" new project design 2 * 660 MW ultra supercritical coal-fired steam turbine generator set.Boiler of Dongfang Boiler (Group) ultra supercritical pressure parameters of DC furnace produced by limited by Share Ltd, with a reheat, balanced ventilation, open layout, solid state slag, steel frame, full suspension structure - type boiler, model DG2060/26.15-II2.

Table 1. Boiler design parameters

parameter	unit	BMCR	BRL
Superheated steam flow	t/h	2060	1956.9
Superheater outlet steam pressure	MPa(g)	26.15	26.03
The superheater outlet steam temperature	℃	605	605
Reheating steam flow	t/h	1659.02	1582.01
Inlet steam pressure	MPa(g)	5.33	5.08
Heater outlet steam pressure	MPa(g)	5.13	4.9
Heater inlet steam temperature	℃	362	357
Heater outlet steam temperature	℃	603	603
Feed water temperature of coal feeder	℃	297	293
Flue gas temperature of air preheater (unmodified)	℃	132	129
Air preheater outlet flue gas temperature (Amendment)	℃	126	123
Actual fuel consumption	t/h	291.03	279.23
Boiler thermal efficiency (low calorific value)	%	92.62	92.75

3. Blowing parameters

The pipe with stage flameout depressurization blowpipe, include: pipe heating surface of boiler tubes (steam section) and connecting pipe, main steam pipe, cold reheat steam pipe, hot reheat pipe, one or two stage Desuperheater Water pipe (steam side blowing), high pressure bypass, high pressure turbine steam inlet pipe.

The wind coefficient is larger than 1 under the premise, according to the recommended data provided by the manufacturer, pressure control method given in pipe separator between 6.5 ~ 7.1MPa, intermittent pressure lasted about 110s, close the door control parameters of temporary flushing at about 4.0MPa, coefficient of 1.1 ~ 1.6 pipe superheater, reheater pipe coefficient up to 1.2 ~ 3.2 the main steam temperature, the highest temperature of 420℃, reheat steam temperature up to 410℃, were not more than 450℃(turbine side cooling pipe for carbon steel re-entry allowed a maximum temperature of 450℃）[2].

4. Main steam temperature control

Once-through boiler from the ignition temperature and pressure to turn before the start process with once-through boiler is similar, most control of once-through furnace intermittent pressure steam temperature during the boiler blowing process can refer to, but there are a few need according to the characteristics of once-through furnace itself to don't treat below detailed analysis of once-through control points in the process of blowing furnace pressure of main steam temperature.

4.1. Feed water temperature

The higher the water temperature is, the higher the steam production is, the lower the main steam temperature is in the other conditions. For the high capacity pulverized coal boiler feed water temperature of 10℃, the main steam temperature is reduced from 4 to 5℃[3]， So as far as possible to improve the water temperature is conducive to prevent the main steam over temperature.

4.2. Total air volume

The overall performance of boiler superheater convection, the total air volume is lower, ceteris paribus, flue gas flow rate is low, less heat superheater, the main steam temperature is low. The general requirement of 30~35% boiler air volume, air plasma manufacturers recommend 40%, to prevent the ignition stage flue tail two times burning in the buck blowing process, ignition can control the volume

of 40%, when the torch blew 10 times, burning the basic stability of the main steam temperature rise slowly after gradually reduce the air to 30%.

4.3. Feed water flow

The water flow is low, in other conditions unchanged, increasing steam production, the main steam temperature is low, but in order to prevent water wall tube flow in part screen refrigerant stagnation, backflow phenomenon, DC furnace must maintain the water flow in the start-up process (generally rated evaporation 25~30%)[4], In order to shorten the start-up time and reduce the boiler water consumption, the water supply can be reduced to 21%. Xinchang power plant boiler manual water flow low alarm value 378t/h 20s MFT336t/h low delay, low low delay 3s MFT252t/h, when the water flow pipe wall temperature 420t/h, the highest water temperature of 280℃ (482℃ alarm value).

4.4. Coal consumption

In the water under the same condition, the quantity of coal is less, the main steam temperature is lower, but the coal amount is too small, the main steam pressure not up to speed 3 times an hour blowing requirements, so to control an appropriate amount of coal, open temporary flushing first decreased the amount of coal a door the temporary rushed after the door is closed, and the coal quantity according to boost speed, to complete a torch.

4.5. Separator water level

Boiler separator is made up of 361 level while the valve in the automatic control of a value, but in the blowing process should pay attention to the 361 valve some manual operation, the specific operation is as follows: open the door before the 361 temporary flushing valve manual and automatic cutting off, the water separator from the automatic control of 12m to suppress 24m (depending on how much water the specific range and to open the door when the liquid level rises and the false water level), the pressure of the separator has reached the flushing pipe parameter, open Lin rushed the door, rushed the door closed after the temporary separator, water level will be decreased and then rose, until the beginning of the rise, open the valve 361 to about 30%, when the water level dropped to about 12m for automatic water level. In the blowpipe, separator in high water level, this has three advantages: one is the temporary flushing after opening, the main steam pressure drop, a lot of saturated water due to flash effect to vapour, the main steam pressure decline slowed down, and the duration of the high growth flush coefficient, enhanced single pipe flushing effect; two is large saturated water to flash into steam and steam expands rapidly, the steam water intensifies, so as to reduce the effect of water, the main steam temperature; three is from 12m 24m to hold water separator process, separator outlet pressure rapidly increased about 0.2MPa, thus saving the amount of coal required for 0.2MPa pressure rise up, to reduce the main steam temperature of indirect effect.

4.6. The time of the door switch

Lin Chong door switch time shorter, blowpipe during temporary flushing valve throttling loss is small, the steam instantaneous momentum is greater, the blowing effect better, thereby reducing the pipe blowing cycles, also indirectly to reduce the temperature of the main steam. In accordance with the provisions of the 1998 edition of "start for the steam blowing unit", temporary flushing door switch total travel time requirements of not more than 60s, personally think that should require the temporary flushing door switch time is less than 30s, Xinchang power plant pipe near to flush door switch time 23s.

5. Conclusion

The new project of Jiangxi Xinchang power plant 2 * 660 MW ultra super critical boiler start-up debugging stage flameout depressurization blowpipe, and achieved the desired results, main and reheat steam temperature is within the allowable range. Based on the reasonable control of some key factors

of the steam temperature, main steam temperature can prevent the problems of ultra super critical boiler blowpipe during depressurization.

Reference:

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