

# Revamping of a 75t/h Pulverized Coal-Fired Boiler to a 65t/h Oil Shale-Fired High-Low Bed CFB Boiler

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## Introduction

Circulating fluidized bed (CFB) combustion technology is a kind of advanced technology for burning oil shale. A 75t/h pulverized coal-fired boiler has been successfully revamped to a 65t/h oil shale-fired CFB boiler employed by high-low bed CFB combustion technology. The retrofit design of 75t/h boiler was finished by Northeast Dianli University and made by Jiangxi Jianglian Energy & Environment Co., Ltd. The 65t/h boiler was installed in Suixi Cement Factory, Guangdong province, China, and it successfully put into operation in 2007.

## 75t/h pulverized coal-fired boiler

The 75t/h pulverized coal-fired boiler is a single-drum, natural-circulation,  $\Pi$ -type boiler designed by Dongfang Boiler Factory in 1993 (Fig. 1). The designed fuel was Category II bituminous coal with heating value 18855kJ/kg. The steam pressure is 3.82MPa and the steam temperature is 450°C.

## 65t/h Oil Shale-Fired CFB Boiler

The high-low bed CFB combustion technology was employed to the retrofit of 75t/h pulverized coal-fired boiler. The structure of the 65t/h oil shale-fired high-low bed CFB boiler is shown in Fig.2. The designed fuel is Maoming oil shale with heating value 5434kJ/kg. No sorbent was used because of self-desulfurization of oil shale.

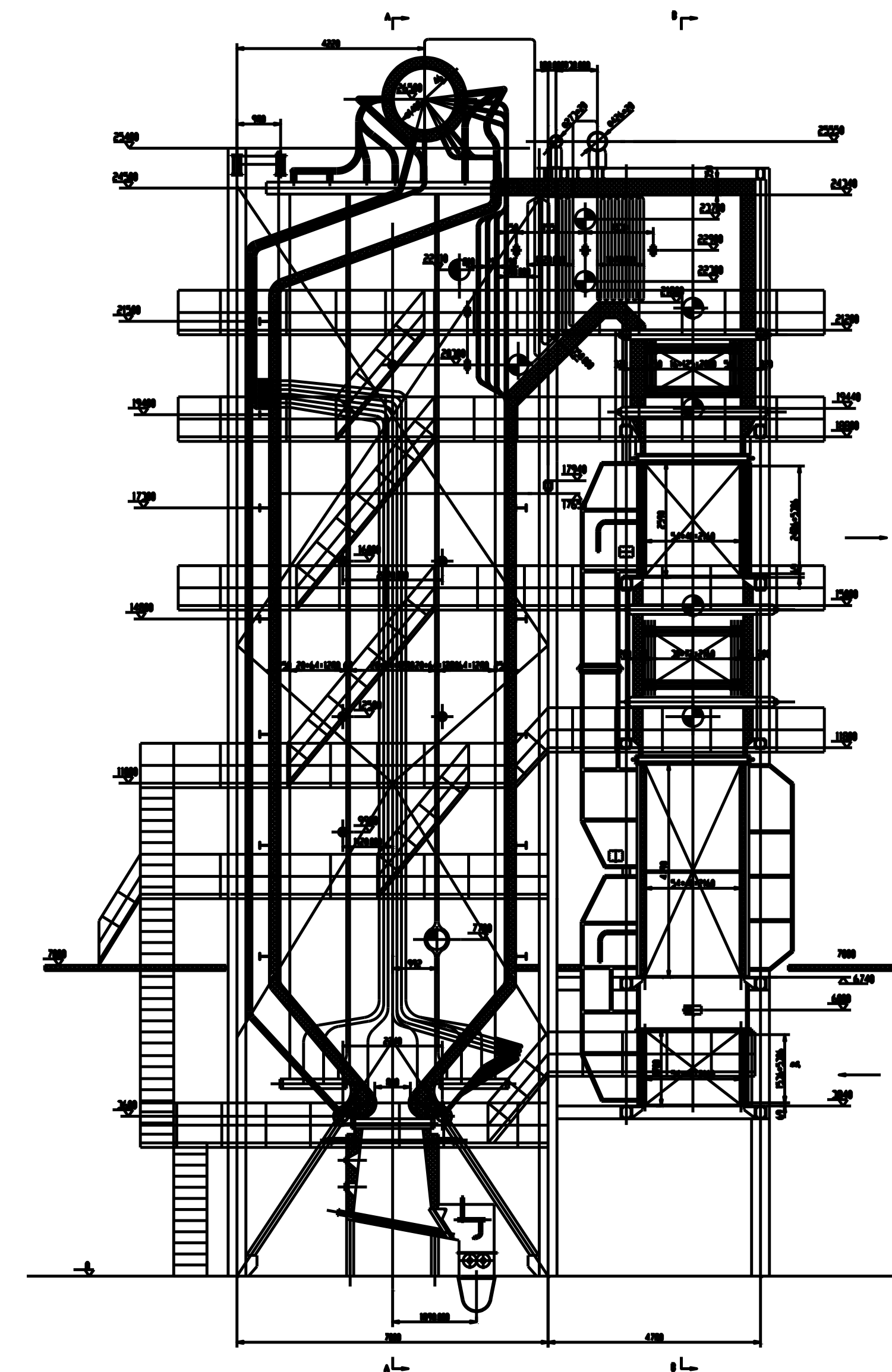


Figure 1: 75t/h pulverized coal-fired boiler

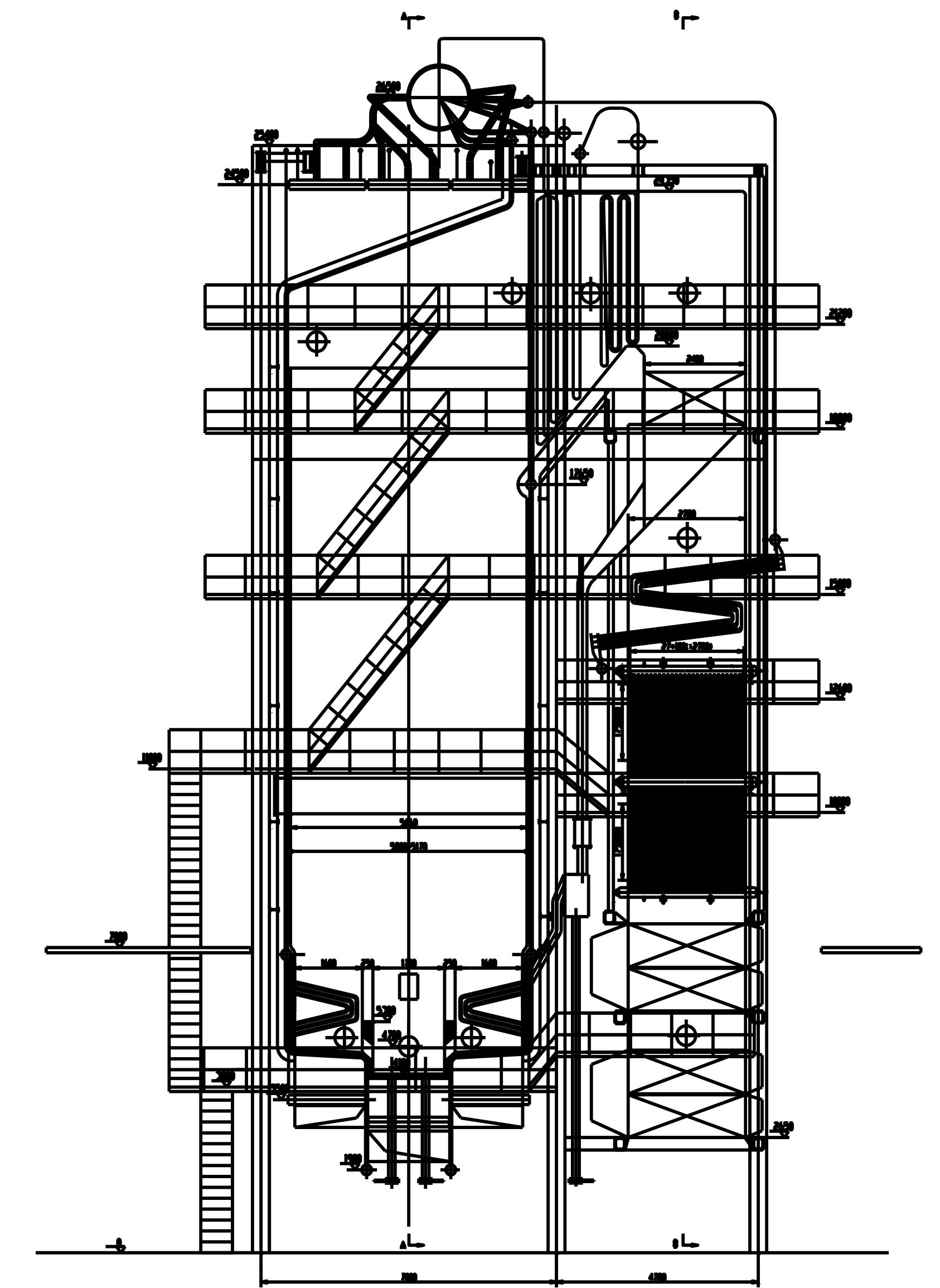


Figure 2: 65t/h oil shale-fired high low bed CFB boiler

## Performance Test

Two kinds of Maoming oil shale with heating value 4070kJ/kg and 4150 kJ/kg were respectively used to test and verify thermal performances of 65t/h oil shale-fired CFB boiler. The main design parameters and the test results are shown in Table 1.

## Conclusion

The 65t/h high low bed CFB oil shale-fired boiler has been operated for several years. The performance tests showed that the retrofit is successful.

Table 1: Main parameters of 65t/h boiler under design and test conditions

Items	Design value	Test value 1	Test value 2
Steam capacity, t/h	65	63.3	63.5
Steam pressure, MPa	3.82	3.68	3.68
Steam temperature, °C	450	440.8	438.7
Feed water temperature, °C	104	111	111
Cold air temperature, °C	20	17	17
Stack gas temperature, °C	150	199.5	197.5
Waste heat loss, %	9.18	10.80	10.86
Unburned gas loss, %	0.50	0.74	0.84
Unburned carbon loss, %	4.04	1.06	0.95
Heat leakage, %	0.80	0.80	0.80
Thermal loss of bottom ash, %	1.78	2.52	2.42
Combustion efficiency, %	95.46	98.20	98.21
Thermal efficiency, %	83.70	84.07	84.13