

Study of Heat Recovery from Waste Heat Recovery Boiler in Dariba Lead Smelter

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Abstract— The excess heat in the Off-Gas (which is at ~1150°C) is recovered as steam in the Waste Heat Recovery Boiler System along with collection of off-gas dust. Some of the Dust in the stream gets collected at the bottom of the Boiler which is conveyed by a chain conveyor to the common dust chain conveyor of Dust Collection System. This dust which is rich in lead (~60% Pb) in the form of PbO is then sent to the SKS feed pelletizer through a weigh feeder and a Bucket Elevator.

Key words: Waste Heat, Heat Recovery

I. INTRODUCTION

Waste heat is heat, which is generated by the combustion of fuel or chemical reaction, and then “dumped” into the environment, even though it could still be reused for many useful and economic purpose. Methods or strategies to recover this heat depends on the temperature of the waste heat gases and the economics involved [1]. Very large amount of hot flue gases is generated from Boilers, Kilns, Ovens and Furnaces. By recovery of some amount of heat from waste flue gas a considerable amount of primary fuel could be saved. It is a fact that, the energy loss in waste gases cannot be fully recovered. However, much of the heat could be recovered [2].

II. MATERIALS AND METHODS

Study area selected for the project is HZL (Hindustan Zinc Ltd) Dariba Lead Smelter having 1LTPA (lakh tonne per annum) capacity , village- Dariba , Tehsil-Relmarga , District- Rajsamand and state- Rajasthan.

The high temperature off gas from the SKS furnace will go through the waste heat boiler, dust collection system and acid-making system.

The waste heat boiler is used to cool the high temperature off gas, fully recover the heat of the off gas and recover part of the metal dust which can create favorable condition for further dust collection [3,4].

The steam produced in the waste heat boiler will be supplied for domestic and production use by the pipe network.

A. Fume condition of the furnace waste heat boiler:

Off Gas input of waste heat boiler : 24055 Nm³/h

Inlet Gas temperature : 900±100°C

Off Gas composition (%) :

Gas	SO ₂	SO ₃	O ₂	H ₂ O	CO ₂	N ₂
V%	11.47	0.62	10.71	17.03	5.26	54.92

Table 1: Off Gas composition

Dust content (outlet) 179 g/m³

B. Main Technical Parameters of the Waste Heat Boiler for Furnace:

Working pressure : 4.0 Mpa , Rated evaporating capacity : ~10 t/h , Rated temperature : 251.8°C

Water supply temperature : 104°C , Temperature of discharged fume : 360±20°C

C. Structure of the waste heat boiler for the furnace:

The boiler is composed of uptake flue, radiation chamber and convection area. The heating surface and pipe column are made of seamless steel pipes. The bottom of the uptake flue of the waste heat boiler is connected with the outlet of the furnace . Curved off take transition piece is used for the seal of the fume when furnace rotates and is located at the bottom of the uptake flue. Emergency off gas exit chimney is also arranged on the heating surface. The straight part of the uptake channel is high and the melting dust can flow to the smelting furnace by gravity which can reduce the accumulation of ash on the heating surface. The temperature of the uptake channel outlet gas is about 700~800°C.

The radiation cooling space of waste heat boiler and convective region is in horizontal arrangement. The radiation cooling space is composed of the heating surface in the membrane wall structure and the spacing between pipes is 80mm. The off gas will go through the radiation cooling space to the convective area. The outside wall of the convective region is of all membrane structure and the spacing between pipes is 100mm. In the flow direction of the off gas, there are Evaporator Bundles. The Evaporator Bundles are made of boiler steel pipes. After going through the convection zone the temperature will drop to about 360°C and the off gas will be discharged from the waste heat boiler and go into the dust collection system. The boiler drum of the waste heat boiler is located at the roof platform of the SKS furnace plant [5].

Rapping devices are provided in the waste heat boiler which can effectively remove the accumulated dust on the heating surface in time and ensure the proper running of the boiler. Dust scraper conveyor is installed under the hopper of the waste heat boiler. The dust from the waste heat and the dropped clinker under the impact of the rapping devices will be sent to the dust collection section by the chain conveyor.

D. Thermal Power System of the Furnace Waste Heat Boiler House:

The de-mineralized water will be sent to the de-mineralized water tank and then pumped to the deaerator to remove the oxygen . The deoxidized water will be pumped into the waste heat boiler drum in which it will be mixed with boiler water. Then it will go to the hot water circulating pump via down comer. After being pressurized by the hot water circulating pump, the circulating water will be sent to the heating surfaces of waste heat boiler in which it will be heated. Then it will return to the drum. The returned steam and water

mixture will be separated in the drum. The separated water will continue to circulate while the saturated steam will be led out of the drum and supplied to the steam network of the Dariba Smelter Complex at battery limit.

E. Arrangement in the Furnace Waste Heat Boiler House:

Regular blow down tank, heat exchanger pump, hot water circulating pump, on line analyzer, de-mineralized water tank and de-mineralized water pump are on level $\pm 0.00\text{m}$ of the auxiliary span in the waste heat boiler house. Low pressure dosing device, high pressure dosing device, and deaerator and tank for de-aerating water are on level **+21.00m**. The horizontal section of the waste boiler for furnace is located at +28.50m level of the boiler house.

F. Water Supply Quality for SKS Furnace Waste Heat Boiler:

Hardness: $\leq 2 \mu\text{mol/L}$, Electric conductivity: $< 5 \mu\text{s/cm}$, SiO_2 : $< 0.1\text{mg/L}$, PH : 8.8-9.2

Boiler water quality - Phosphate radical : 5-15 mg/L, PH (25°C): 9-11

III. RESULT

Waste Heat Recovery Boiler system of Dariba Lead Smelter is very efficient and produces 12 t/h steam by recovery of waste heat from off gas. Steam is being utilized for further heating activities.

IV. CONCLUSION

One of the best way to minimize the usage of traditional fuel is recovery of heat from byproduct of any process or technique, it is sustainable way of development. Waste heat recovery boiler of Dariba lead smelter produce significant amount of steam which helps in reducing the use of fossil fuels and also prevent the air pollution of that area by lowering down the temperature of off gas [6].

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