SHIJIAZHUANG IRON & STEEL COMPANY LIMITED

Installation of Gas Hoods on Converter Furnace to Recover Heat

SUMMARY OF THE OPTION

Shijiazhuang Iron & Steel Co., Ltd. ("Shigang") is a state-owned integrated steel plant located in Shijiazhuang city, the capital of Hebei province in China and produces 2 million tons of carbon structural round steel per year.

Waste heat from two Converter Furnaces is used to generate steam. During the energy assessment, the Team observed that the operating pressure is much lower than the design pressure, and as a result the possible uses for this low pressure steam are limited, and large quantities of steam is therefore vented into the atmosphere. This was caused by steam leaks in the pipework and the furnace hoods.. The Company replaced four gas hoods at the mouth of the two converters to recover heat and reuse steam. The investment of this option was US$ 720000, annual savings are US$ 900000 and payback period was about 10 months. It also had good environmental benefits with steam recovery reaching 148000 tons per year, which indirectly reduced CO_2 emissions (although these were not quantified). In addition, through the implementation of the project, several concealed problems in the production system were eliminated.

KEY WORDS

China, Iron and Steel, Furnaces and Refractories, Waste Heat Recovery, Converter Furnace, Gas Hood

OBSERVATIONS

At *Shigang*, the long steel making process uses two converter furnaces to commence the process of converting iron, made in the blast furnaces, to special grade steels. Steel made in the converter furnace is further refined by Vacuum Degassing (VD) before it is continuously cast at the Concasters. The main products produced are cylindrical rods of different steel grades and various diameters.

Heat generated from the two converter furnaces is used to convert cooling water to steam. The furnace generates about 20 tons steam per hour (Tph). The steam system was designed to a maximum operating pressure of 24.5 kg/cm^2, but the plant currently operates at about 6 – 8 kg/cm^2. This was caused by old and corroded pipework, which caused many leaks in the cooling water piping, particularly in the furnaces hood cooling water loop.

The plant has limited options to utilize this large amount of steam at the current low generation pressure. The adjacent Vacuum Degassers (VD) require about 16 Tph of 16 kg/cm^2 steam. But, unless the steam generated at the converter furnaces is at least 16 kg/cm^2, the VD's cannot use it.

As a result of the limited current users of steam, about 500 – 600 tonnes of this clean steam is vented to the atmosphere daily.

In addition, water leaks inside Furnace Hood during Charge Preparation were causing losses of approximately 50 liters/hour. Several leaking tubes were noted.

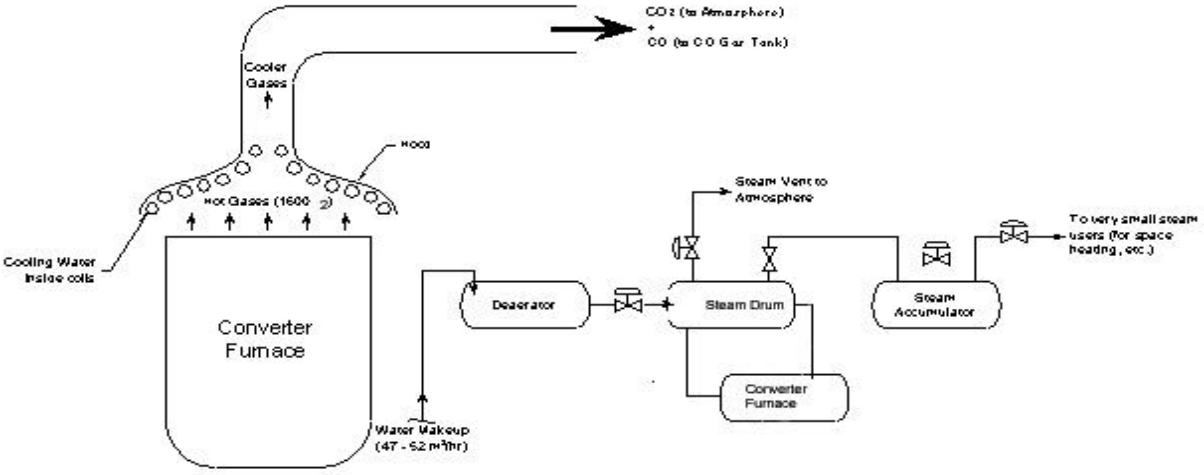

Figure 1: Converter Furnace: Waste Steam

OPTIONS

The Team recommended recovering the heat from the wasted steam. The temperature of the gases emitted from the oxygen-injection steel-making process can reach about 1600^0C. Shigang recovered the waste heat by installing four gas hood on the mouth of the two converter furnaces. The gas hoods can be movable gas hoods or fixed flue depending on the installation position.
The gas hoods collect gas, which goes through the movable hoods and enters gases cooling flue. The gas hood needs to be moved away during tapping (i.e. adding waste steel and letting out molten iron) to avoid obstructing the movement of the converter.

Vaporization cooling is used to transfer heat to the cooling water through vaporization. Vaporization cooling can absorb 2721.4kJ heat per kilogram water, while water cooling can absorb 20-84kJ heat per kilogram water and is therefore less efficient. The vaporization cooling equipment have to endure steam pressure in the same way as a pressure container does and therefore the quality requirements on the equipment are very rigid.

This option was implemented in June 2004. The picture of vaporization cooling gas hood is shown in figure 2.

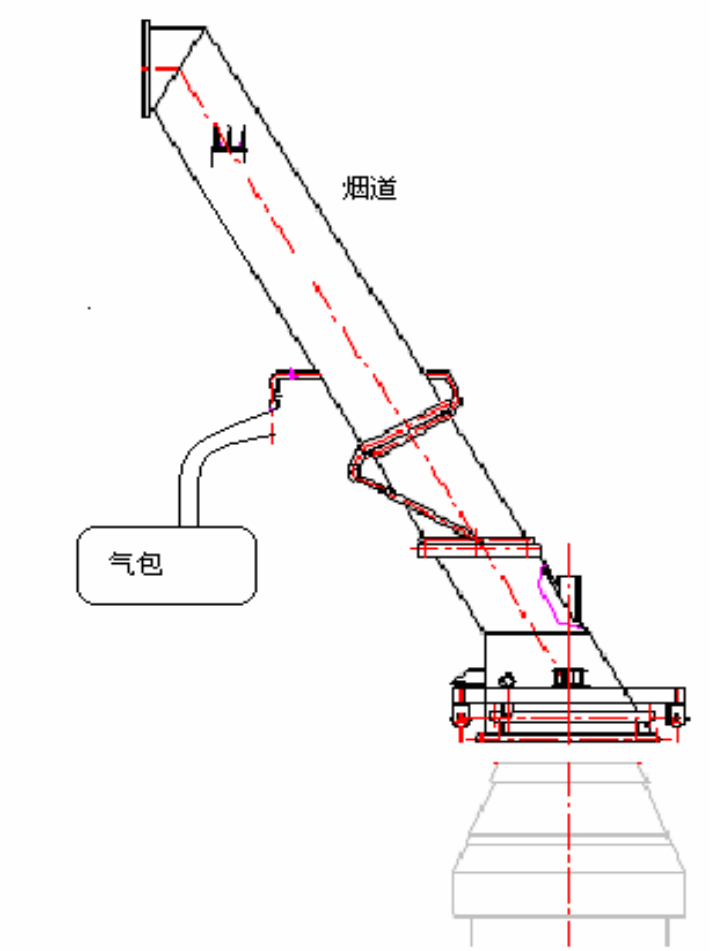

Figure 2. Schematic overview of the vaporization cooling gas hood

RESULTS

Financial benefits

- Investment: US$ 720000
- Annual cost savings: US$ 900000 (= 50 RMB/t steam X 20 steam/h X 24h X 365days X 85%)
- Payback period: about 10 months.

Environmental benefits

- Annual steam recovered: 148000 tons
- Annual energy savings: not quantified (steam is generated using waste heat from furnaces)
- GHG emission reductions: indirect reductions, but these were not quantified

Other benefits

- Concealed problems in the production system were eliminated
- Working conditions have been improved

FOR MORE INFORMATION

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