ANHUI LINQUAN CHEMICAL INDUSTRY COMPANY LIMITED

Heat Recovery from Blown Gas and Relaxed Gas at Water Gas Production

SUMMARY OF THE OPTION

Anhui Linquan Chemical Industrial Company Ltd. is a middle size chemicals producer located in Anhui province, Middle China. It produces over 1 million tons of chemicals, mainly urea and ammonia.

Water gas production department is one main raw material consumer. The water gas production department emits great quantity of blown gas and relaxed gas containing heat, which results in energy loss.

A heat recovery system was installed to recover heat from emitted blown gas and relaxed gas, and reduce CO emissions at the same time. The system consists of a F7500 burning furnace, tunnel boiler equipment, inner high temperature injection cup and baffling gas channel of furnace. Emitted blown gas and relaxed gas is mixed in the burning furnace, which causes self-ignition. The resulting heat is recovered in the heat recovery boiler and used for the generation of electricity and in the urea production section.

Total annual savings were US$ 1,225,033 (10,100,000 RMB), with an initial investment of US$ 624,242 (5,150,000 RMB) and a payback period of only six months. The actual energy saving of 33,643 tons coal per year was equal to CO_2 emission reductions of 51,137 tons per year. This is certainly an energy saving project with financial and environmental benefits.

KEY WORDS

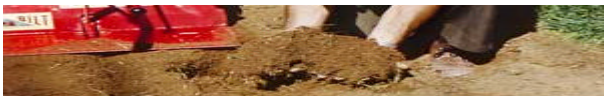
China, Chemicals, Waste heat recovery, Water gas, Water gas production department, Blown gas, Relaxed gas

OBSERVATIONS

The water gas production department emits great quantity of blown gas and relaxed gas containing heat, which results in energy loss. These gases contain CO, with a concentration of 10,000 ppm, which is one of the main atmospheric pollutants.

The process flow in the gas production department contains gas flow, steam flow and oil flow. The water gas supply section takes lump coal as raw material, air and overheated steam as the gasifying agent. The fixed layer discontinuous gasifying method includes blowing process and the gas production process. It was found that heat is lost during these processes:

- The blowing is to supply as much reactive heat, which is preserved in carbon layer, for gas production process as much as possible in a unit time. During the reaction of carbon and oxygen, if the temperature is higher than 100°C, the reaction will be speeded up, and the concentration of product, CO_2 sharply increase while giving off a lot of heat. During



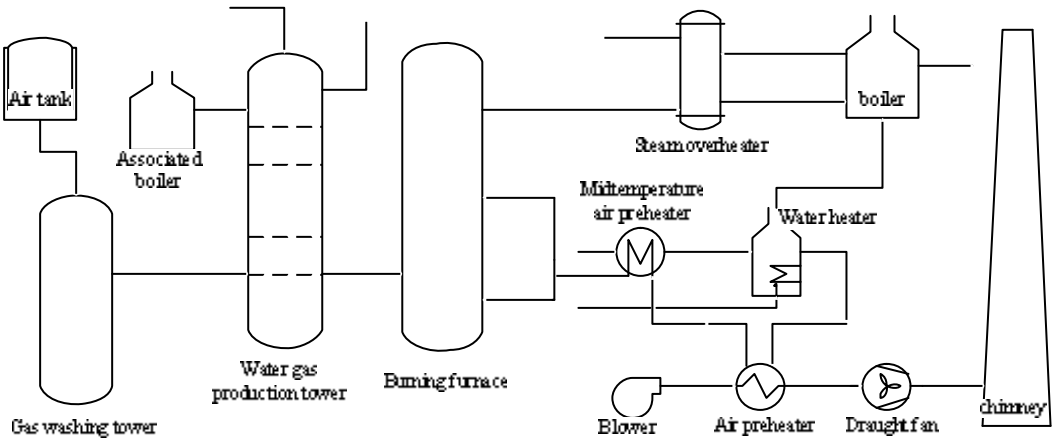
the blowing process, it is better to reduce the endothermic reaction, when CO_2 is deoxidized into CO, in order to avoid heat loss.

- During the gasifying process of carbon and steam, the hydrogen is deoxidized form steam by hot carbon. The emission of hydrogen accelerates to yield more hydrogen and carbon monoxide, and increase the rate of reaction. The high temperature is good for decomposition of steam and deoxidization from carbon dioxide to carbon monoxide. This also restrains production of methane. What's more, it is good for steam decomposition to increase the thickness of gasifying layer and reaction time of steam and carbon.

OPTIONS

- A heat recovery system was installed to recover heat from emitted blown gas and relaxed gas, and reduce CO emissions at the same time. The system consists of a F7500 burning furnace, tunnel boiler equipment, inner high temperature injection cup and baffling gas channel of furnace. These advanced patents will realize secondary combustion of blown gas from gas production mixed with relaxed gas from synthesis. This system will recycle low-temperature sensible heat and hidden heat, and also decrease the resistance force of the system.
- Blown gas with a temperature of 260°C from twelve gas producers in the gas production section, going through F1400 pipes, is fed into the heat recovery system by three or two fans in overlapping feeds. The blown gas sufficiently mixes with relaxed gas from the synthesis section before it is fed into a burning chamber of the F7500 burning furnace. The temperature in the chamber is higher than 650°C, causing the mixed gas to self-ignite.
- After self-combustion, the temperature of the gas reaches up to 850-900°C. The temperature of the gas is reduced to 141°C after it passes through the heat recovery boiler, steam heat exchanger, water cooler, coal economizer and air preheater to recycle heat. After washing, the gas is emitted or recycled in the drying kiln in the coal shaping section as secondary heat.
- The deoxidized and desalted water with a temperature of 105°C, is first transported by a feed pump from the heat & power department, and then changed into steam with a temperature of 450°C and a pressure of 3.82MPa in the heat recovery boiler. This steam is fed back to the heat & power department to produce electricity. The remaining steam with a temperature of 240°C and a pressure of 1.3MPa is supplied for urea production section.

Figure: Flow diagram of heat recovery system in water gas production department



Financial benefits

- Investment: US$ 624,242
- Net annual cost savings (cost savings – operating costs): US$ 1,225,033
- Payback period: 6 months

Environmental bene fits

- Annual coal savings: 33,643 tons
- Annual GHG emission reduction: 51,137 tCO_2 (33,643 t coal X 1.52 tCO_2/t coal)
- Other annual savings:
  - SO_2: 4 tons
  - NOx: 183 tons
  - CO: 8 tons
  - PM_{10}: 202 tons

FOR MORE INFORMATION

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