



ANHUI TIANDU PAPER COMPANY LIMITED

Heat Recovery from Blow Down at Pulp Digesters

COMPANY DESCRIPTION

Anhui Tiandu Paper Co. Ltd. is a medium sized paper company located in the Liushipu Industrial Development Area, Anhui Province, China, and currently produces up to 50,000 tons of industrial paper per year for the domestic market, but expanding production capacity to 200,000 tons/year.

The company installed heat recovery equipment on every digester and reused this heat to produce hot water. This hot water is reused in other process areas such as the presoaking process and washing process. Investment costs were US\$ 36364, annual savings are US\$ 49,697 and the payback period is 9 months. Each year, 5022 tons of coal is saved, resulting in a reduction of 7634 tons CO₂ emissions and of SO_x, NO_x, CO and PM10 emissions.

KEY WORDS

Pulp and Paper, China, Waste Heat Recovery, Digester, Blow Down, Steam

OBSERVATIONS

The pulp production department has five digesters, unwashed storage tanks, washing machines, and centrifugal screens. It was a focus area because of high raw material and energy consumption compared to other areas. During the pulp-making process, 150 thousand tons of steam was needed in one year, and the cost for steam was about US\$ 61800. Because of high heat loss through blow down, it was suggested to recover the heat from blow down for every digester.

OPTIONS

The recovery of blow down is shown in Figure 1 and involves the following steps:

- **Steam/pulp separator.** When cooked pulp is fed into a flow tank, steam and pulp are separated by centrifugal force. The pulp will fall to the bottom of the tank, while steam rises to the gas cap and is then pumped out. It is possible that the steam still contains a little bit of pulp, so it is conveyed to another separator for further separation. The pulp is rotated, collected with downward airflow, and taken to the tank again through a pulp pipe. Meanwhile, steam will go upwards into a heat changer, where the heat exchange occurs.
- **Heat exchanger.** After entering the heat exchanger, the steam is mixed. Consequently, steam will be condensed quickly and collected in the recovery pot as hot water. Hot water is then delivered by a special water pipe to any work section wherever hot water is needed. The heat changer is positioned above hot water tank, so the hot water can directly be poured into the tank. Blowing only takes place over a short period (about 20 minutes), so the more heat is exchanged, the better. It must be ensured the exchanged heat is more than 11055 MJ/h. However, a heat exchange of 12000 – 14000 MJ/h is preferred.

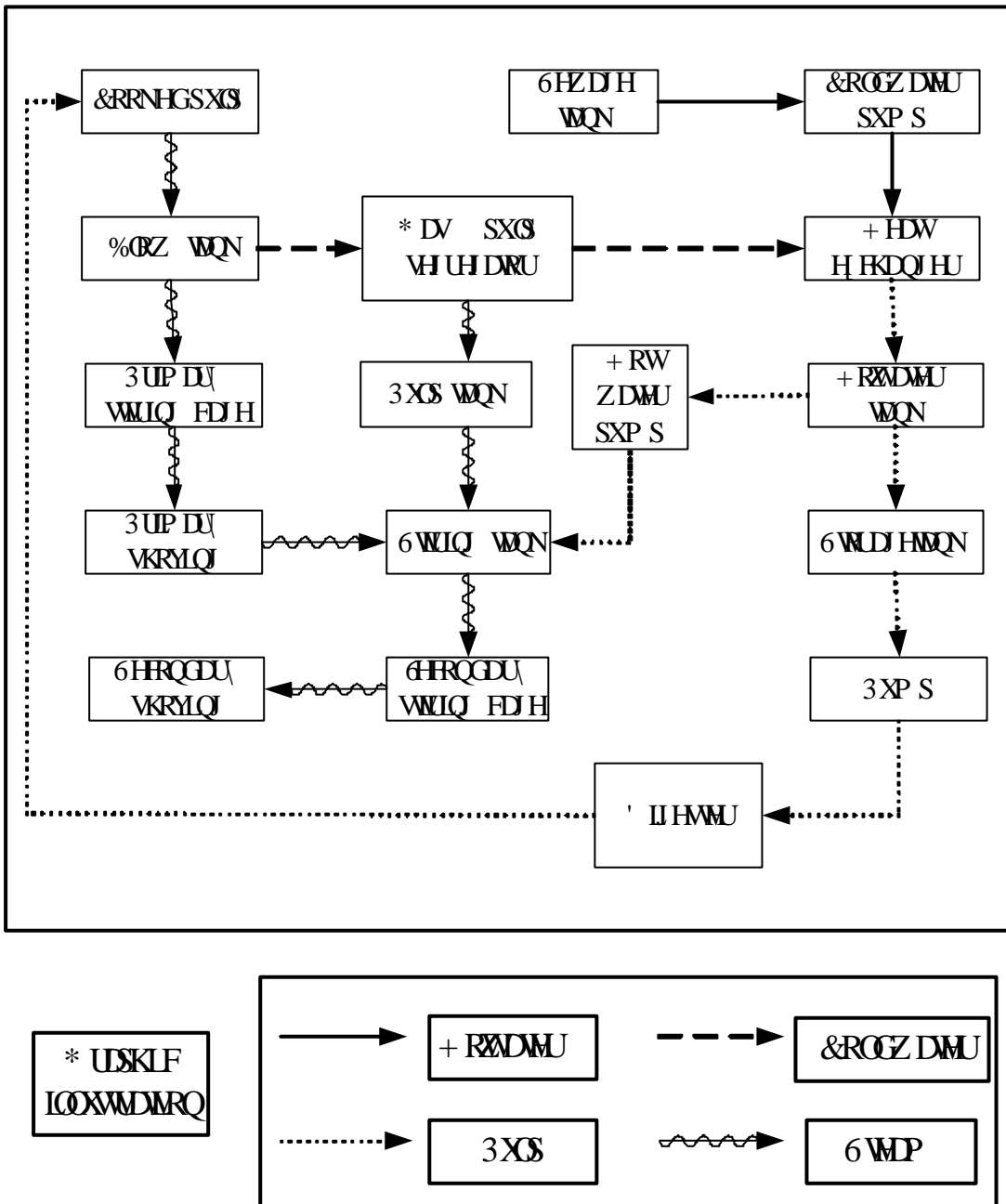


Figure 1: Process flow chart of heat recovery from steam blow down

- **Gas and pulp segregator.** A gas and pulp segregator is used to separate pulp from blown steam. 1.5 – 2 digesters of pulp remain in the blow tank after blowing, avoiding that too much pulp is fed into the segregator for a thorough separation.
- **Hot water tank.** The hot water tank locates 1.5 – 2 meters above ground, so the water can naturally flow to the chemical pot (also flowing to secondary stirring cage or shoving tank, if necessary) by the gravity force. The tank can be rebuilt from disused digester in order to avoid charging of insulation materials. One old digester for one blow tank is enough.
- **Hot water pump.** The purpose of the hot water pump is to transport pulp to the secondary shoving tank, so the pump can be omitted if the tank is located below the hot water tank and the liquor flows into the tank by force of gravity.



The amount of steam blow down is 1300 – 1500 m³ per hour, and the recovered blow down is about 900 – 1100 kg per ton liquor. There are three ways of reusing the heat from the steam and blow down:

- **White liquor preheating.** Preheating the white liquor that is immediately fed into the digester. The recovered heat could warm up the liquor up to 10 – 12°C, and generally, reuse 220 kg steam per ton liquor blown out.
- **Black liquor evaporation.** Utilizing steam heat to evaporate black liquor could save 23% of thermal power currently used for evaporation.
- **Hot water production.** If it is assumed that after the blow process, the maximum temperature of cooked liquor decreases from 160°C—170°C to approximately 100°C, and therefore it gives off 2303 MJ heat. This means that if we warm up cold water of 20°C to 70°C, we could get 11 tons hot water from the steam blow down per ton liquor produced.

Reusing energy for preheating the white liquor only recovers 20 % of heat as hot water production can recover. But its process is simple and the investment is small. More heat will be recovered by hot water production, but the investment is much larger. Blowing process cannot use all the hot water, and the surplus can only be used for washing pulp.

RESULTS

Financial benefits

- Investment: US\$ 36,364 or 300,000 yuan
- Annual cost savings: US\$ 49,697 or 400,000 yuan
- Payback period: 9 months

Environmental benefits

- Annual coal reduction: 5,022 tons
- Annual GHG emission reduction: 7634 tons
- Other annual emission reductions.
 - SO₂: 0.56 tons ($5022.27 \times 35 \times 0.7\% \div 2.2 = 559.3kg$)
 - NO_x: 27 tons ($5022.27 \times 12 \div 2.2 = 27.39T$)
 - CO: 1.14tons ($5022.27 \times 0.5 \div 2.2 = 1141.4kg$)
 - PM₁₀: 30 tons ($5022.27 \times 13.2 \div 2.2 = 30.13T$)

FOR MORE INFORMATION

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