new products

Gas Turbine Inlet Air-cooling System

The output of gas turbines falls to a value that is less than the rated output under high ambient temperature conditions that often occur during the summer season. This results in a shortage of electric power supply because the output of the gas turbine drops as the flow of inlet air mass decreases due to the increase in temperature of the inlet air. For this reason, it is effective to provide a device to cool the inlet air so as to maintain a sufficient electric power supply level by thus increasing the output of the gas turbine up to its rated power.

This paper presents an overview of an intake air-cooling system that uses a steam absorption chiller and an air cooler to address the above problem. The system was attached to an existing gas turbine plant installed at the Kawasaki Office of ASAHI KASEI CORPORATION and operated successfully. A brief summary is also presented of the running experience of the system.

1. Facility plan and its feature

A steam absorption chiller operated by surplus low pressure steam in a factory was selected to produce cooled water to be sent to the air cooler. Fig.1 shows an outline of the flow of the system. The system is capable of cooling inlet air of 32°C to 15°C. Table1 shows the particulars of the major equipment involved.

The main features of this inlet air-cooling system are as follows. (1) Cooled water can be produced using low pressure steam (0.1 MPaG) as the driving source. (2) Air flowing outside of the coil is cooled by means of running cooled water produced with the chiller into the interior of the cooling coil of the air cooler. (3) Inlet air can be cooled to less than the dew-point temperature of the ambient air because the cooling coil dehumidifies the sucked environmental air. (4) Dew drops condensed on the surface of the coil are removed with a gas-liquid separator that is placed downstream of the coil. The splash of the separator is prevented from reaching the gas turbine side.

2. Results of running operation

The inlet air-cooling system described above was set up on-site in May of 2001 with running operations commencing in June. Fig.2 shows the external appearance of the air cooler.

Running data from June to September was collected and examined. The effectiveness of the system was thus confirmed. A comparison from operational records on a typical summer day of the gas turbine output data in which the inlet air was not cooled in 2000 with data of the system containing the above air cooler in 2001 shows that a mean output increase of 3800 kW (14% of the gas turbine rated output) and an output increase of 92000 kWh per day was realized. Furthermore, the sum total of the increase in output over the period from June through September was 4700 MWh.

Table 1 Particulars of major equipment

Major equipment	Major particulars
Air cooler	Unit quantity: 2 units Volume of air flow:154 250 kg/h Temperature of air at inlet: 32 °C Temperature of air at outlet: 15 °C
Steam absorption chiller	Unit quantity: 1 unit Refrigerating capability: 2 919 kW (830 USRt) Cooled water inlet temperature:12 °C Cooled water outlet temperature: 7 °C

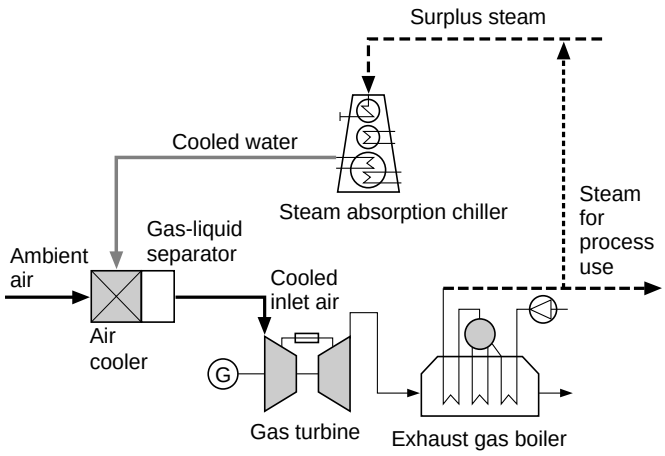

Fig. 1 Outline of the flow of the inlet air-cooling

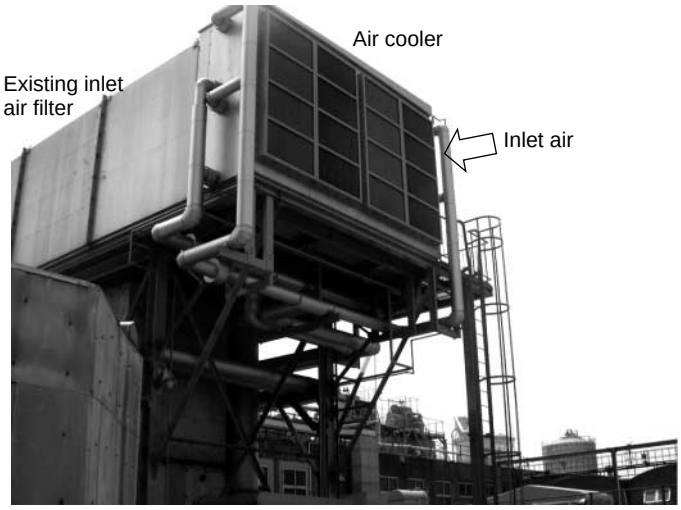

Fig. 2 External appearance of air cooler