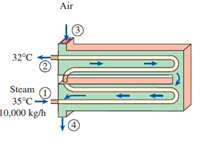
1. A stream of ammonia enters a steady flow device at 100 kPa, 50°C, at the rate of 1 kg/s. Two streams exit the device at equal mass flow rates; one is at 200 kPa, 50°C, and the other as saturated liquid at 10°C. It is claimed that the device operates in a room at 25°C on an electrical power input of 250 kW. Is this possible?
2. A nozzle is required to produce a flow of air at 200 m/s at 20°C, 100 kPa. It is estimated that the nozzle has an isentropic efficiency of 92%. What nozzle inlet pressure and temperature is required assuming the inlet kinetic energy is negligible? Assuming Constant Specific heat.
3. Air in a large building is kept warm by heating it with steam in a heat exchanger (Fig). Saturated water vapor enters this unit at 350C at a rate of 10,000 kg/h and leaves as saturated liquid at 320C. Air at 1-atm pressure enters the unit at 250C and leaves at 36.850C at about the same pressure. Determine the rate of entropy generation associated with this process. The heat exchanger is insulated.
4. Steam enters a turbine with a pressure of 30 bar, a temperature of 4000C, and a velocity of 160 m/s. Saturated vapor at 1000C exits with a velocity of 100 m/s. At steady state, the turbine develops work equal to 540 kJ per kg of steam flowing through the turbine. Heat transfer between the turbine and its surroundings occurs at an average outer surface temperature of 350 K. Determine
5. the rate at which entropy is produced within the turbine per kg of steam flowing, in kJ/kg K.
6. rate of entropy generation in surrounding
7. rate of entropy generation
8. exergy destruction
9. second law efficiency

Neglect the change in potential energy between inlet and exit.

1. Consider an air compressor that receives ambient air at 100 kPa and 250C. It compresses the air to a pressure of 1 MPa, where it exits at a temperature of 540 K. Since the air and compressor housing are hotter than the ambient surroundings, 50 kJ per kilogram air flowing through the compressor are lost. Find the reversible work and the irreversibility in the process.
2. Air enters a 3600-kW turbine operating at steady state with a mass flow rate of 18 kg/s at 1100 K, 3 bar and a velocity of 100 m/s. The air expands adiabatically through the turbine and exits at a velocity of 150 m/s. The air then enters a diffuser where it is decelerated isentropically to a velocity of 10 m/s and a pressure of 1 bar. Employing the ideal gas model, determine

(a) the pressure and temperature of the air at the turbine exit, in bar and C, respectively.

(b) the rate of entropy production in the turbine, in kW/K.