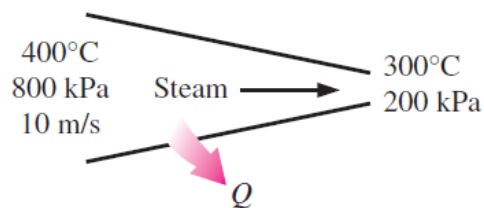


1<sup>ο</sup> ΣΕΤ ΑΣΚΗΣΕΩΝ

Τα προβλήματα αυτά θα επιλυθούν στην τάξη την 19/10/21 και την 25/10/21. Λύσεις θα σας σταλούν την 18/10/21.

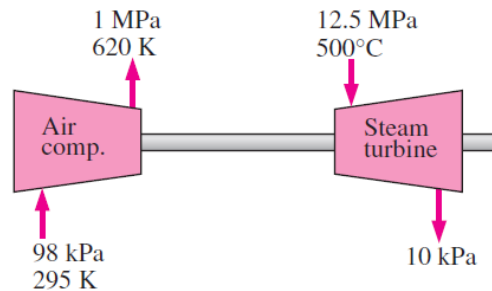
Προβλήματα 5.44, 5.184, 5.199, 5.44 και 5.66 που επισυνάπτονται

**5–44** Steam enters a nozzle at 400°C and 800 kPa with a velocity of 10 m/s, and leaves at 300°C and 200 kPa while losing heat at a rate of 25 kW. For an inlet area of 800 cm<sup>2</sup>, determine the velocity and the volume flow rate of the steam at the nozzle exit. *Answers: 606 m/s, 2.74 m<sup>3</sup>/s*



**FIGURE P5–44**

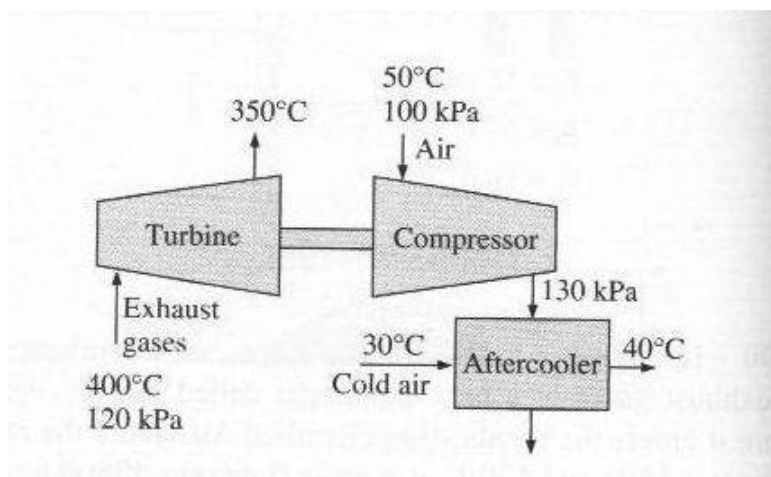
**5-184** An adiabatic air compressor is to be powered by a direct-coupled adiabatic steam turbine that is also driving a generator. Steam enters the turbine at 12.5 MPa and 500°C at a rate of 25 kg/s and exits at 10 kPa and a quality of 0.92. Air enters the compressor at 98 kPa and 295 K at a rate of 10 kg/s and exits at 1 MPa and 620 K. Determine the net power delivered to the generator by the turbine.



**FIGURE P5-184**

(Answer:  $W_{\text{net}}=20,448\text{MW}$ )

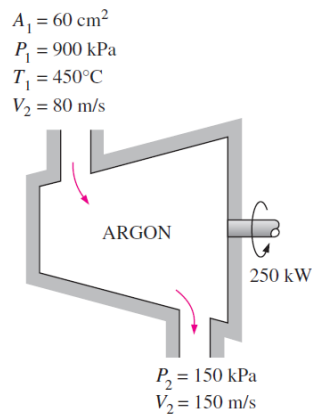
5.199 The turbocharger of an internal combustion engine consists of a turbine and a compressor. Hot exhaust gases flow through the turbine to produce work and the work output of from the turbine is used and input to the compressor. The pressure of ambient air increases as it flows through the compressor, before it enters the engine cylinders. Thus, the purpose of the turbocharger is to increase the air pressure so more air gets into the cylinder. As a result, more fuel can be burned and more power can be produced from the engine.



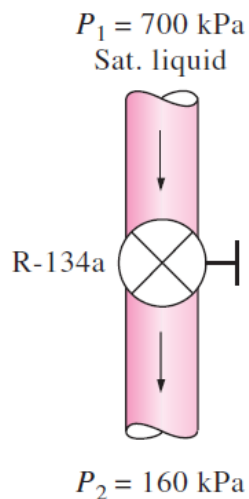
In a given turbocharger exhaust gases enter the turbine as shown at the rate of 0.02 Kg/s. Air enters the compressor at the rate of 0.018 Kg/s. To avoid what is known as engine “knock”, an aftercooler is used to cool the air coming from the compressor, with cool ambient air, before it enters the engine at a temperature no larger than 80°C. Treating the exhaust gases as air, determine the temperature at the exit of the compressor and the flowrate of ambient air needed in the aftercooler.

(Answer:  $T_{\text{air},2}=108.6\text{ }^{\circ}\text{C}$ ,  $Q=44.9\text{ L/s}$ )

**5-54** Argon gas enters an adiabatic turbine steadily at 900 kPa and  $450^{\circ}\text{C}$  with a velocity of 80 m/s and leaves at 150 kPa with a velocity of 150 m/s. The inlet area of the turbine is  $60\text{ cm}^2$ . If the power output of the turbine is 250 kW, determine the exit temperature of the argon.



**5-66** Refrigerant-134a is throttled from the saturated liquid state at 700 kPa to a pressure of 160 kPa. Determine the temperature drop during this process and the final specific volume of the refrigerant. *Answers:  $42.3^{\circ}\text{C}$ ,  $0.0344\text{ m}^3/\text{kg}$*



**FIGURE P5-66**