determine the specific enthalpy of each stream component, including known temperatures and pressures. In addition, show states (phases) of process materials when they are not obvious: do not simply write H_2O, for example, but rather $H_2O(s)$, $H_2O(l)$, or $H_2O(v)$, according to whether water is present as a solid, a liquid, or a vapor.

In the rest of this chapter, we will consider only species (such as water) for which tabulated internal energies or enthalpies are available. In Chapters 8 and 9 we will show how to choose reference states and calculate the required values of $\hat{U}$ and $\hat{H}$ when tabulated values cannot be found.

6-1 Energy Balance on a One-Component Process

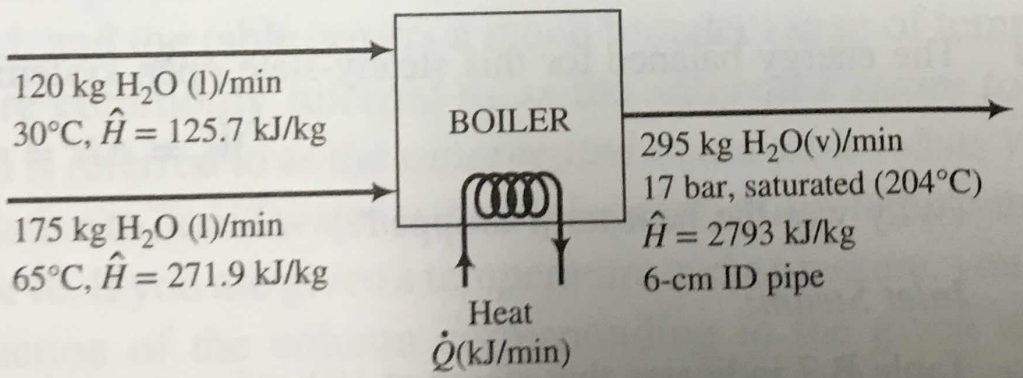
Example 6.1

Two streams of water are mixed to form the feed to a boiler. Process data are as follows:

Feed stream 1	120 kg/min @ 30°C
Feed stream 2	175 kg/min @ 65°C
Boiler pressure	17 bar (absolute)

Steam emerges from the boiler through a 6-cm ID pipe. Calculate the required heat input to the boiler in kilojoules per minute if the emerging steam is saturated at the boiler pressure. Neglect the kinetic energies of the liquid inlet streams.

Solution



1. ***A first step in solving problems of this sort is to determine (if possible) the flow rates of all stream***