Steam separator 3

A saturated mixture with a quality of 60% and a mass flow rate of $\dot{m}_{mix} = 120$ kg/s enters a liquid - steam separator. It is separated in the liquid – steam separator and leaves as a saturated liquid and a saturated vapor.

What is the mass flow rate of the saturated liquid?

Answer: 48 kg/s

Explanation: A quality of 60%, $x = 0.6$ means that 60% of the mass of the mixture is a saturated vapor and 40% a saturated liquid. If the liquid and vapor are separated the mass flow rate of the saturated vapor is: $\dot{m}_{sat.vapor} = x \cdot \dot{m}_{mix} = 0.6 \cdot 120 = 72$ kg/s. The mass flow rate of the saturated liquid is $\dot{m}_{sat.liquid} = (1-x) \cdot \dot{m}_{mix} = 0.4 \cdot 120 = 48$ kg/s. Note that both mass flow rates together should be the mass flow rate of the saturated mixture entering: $\dot{m}_{sat.vapor} + \dot{m}_{sat.liquid} = x \cdot \dot{m}_{mix} + (1-x) \cdot \dot{m}_{mix} = \dot{m}_{mix} \rightarrow 72 + 48 = 120$ kg/s correct.