

Property Data Use in the Closed System Energy Balance

Solution: An energy balance for the closed system is

$$\cancel{\Delta KE} + \cancel{\Delta PE} + \Delta U = Q - W$$

where the kinetic and potential energy changes are neglected.

Thus

$$W = Q - m(u_2 - u_1)$$

State 1 is in the **superheated vapor** region and is fixed by $p_1 = 1$ bar and $T_1 = 100^\circ\text{C}$. From **Table A-4**, $u_1 = 2506.7$ kJ/kg.

State 2 is **saturated vapor** at $p_2 = 2.5$ bar. From **Table A-3**, $u_2 = u_g = 2537.2$ kJ/kg.

$$W = -250 \text{ kJ} - (2 \text{ kg})(2537.2 - 2506.7) \text{ kJ/kg} = -311 \text{ kJ}$$

The negative sign indicates work is done **on** the system as expected for a compression process.