Solutions

2.1

- $w = h_1 - h_2 = 295.2 - 480.5 = \mathbf{-185.3}$ kJ/kg - negative because it is work input.
- $\dot{W} = \dot{m}\,|w| = 1.5 \times 185.3 = \mathbf{278.0}$ kW.

2.2

- $w_p = v\,\Delta p = 0.001005 \times (5000 - 800) = \mathbf{4.22}$ kJ/kg.

2.3

- $\Delta ke = (320^2 - 20^2)/2 = 51{,}000$ J/kg $= \mathbf{51.0}$ kJ/kg.
- $q = w = 0$ gives $\Delta h = -\Delta ke = \mathbf{-51.0}$ kJ/kg: enthalpy falls ✓.

2.4

- The nozzle's product IS velocity, so Δke is the point of the device; a pump moves slow liquid, so Δke is negligible against $v\,\Delta p$.
- Pushing each kilogram through a port costs pv of flow work; absorbing it into u gives h, so ports balance in h.

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