also

$$u_1 = 0.5u_{f1} + 0.5u_{g1} = (0.5)(89.095 \tfrac{kJ}{kg}) + (0.5)(1299.9 \tfrac{kJ}{kg})$$

$$\cong 694.5 \tfrac{kJ}{kg}$$

@ state (2)

T_{sat} for $p_2 = 6$ bar is $T_{sat} = 9.2846\,°C < T_2 = 180°C$

thus, it is super heated vapor.

from the corresponding table @ $T_2 = 180°C$

$$v_2 = 0.36389 \tfrac{m^3}{kg}$$

and

$$u_2 = 1649.4 \tfrac{kJ}{kg}$$

to calculate w_{12} $(\frac{J}{kg})$

w_{12} is the area under the path function of the p-v diagram

therefore

$$w_{12} = \left[(0.36389 - 0.31262)\tfrac{m^3}{kg}\right](1.9008 \times 10^5\,Pa)$$

$$+ \frac{1}{2}\left[(0.36389 - 0.31262)\tfrac{m^3}{kg}\right]\left[(6 - 1.9008) \times 10^5\,Pa\right]$$

$$\cong 20254\ J/kg = 20.254\ kJ/kg$$

thus,

$$q_{12} = \Delta u_{12} + w_{12} = u_2 - u_1 + w_{12}$$

$$= (1649.4 - 694.5 + 20.254)\tfrac{kJ}{kg}$$

$$\cong 975.2 \tfrac{kJ}{kg}$$

$$\boxed{\begin{aligned} w_{12} &= 20.3 \tfrac{kJ}{kg} \\ q_{12} &= 975 \tfrac{kJ}{kg} \end{aligned}}$$