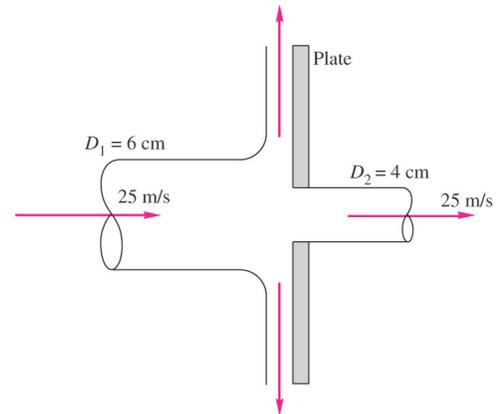


NAME _____

Fluids-ID _____

Quiz 6.

A 6-cm-diameter 20°C water jet strikes a plate containing a hole of 4-cm diameter. Part of the jet passes through the hole, and part is deflected. Determine the horizontal force F required to hold the plate. ($\rho = 998 \text{ Kg/m}^3$)



$$\sum \underline{F} = \sum_{CS} \underline{V}(\rho \underline{V} \cdot \underline{A})$$

Solution:

Horizontal component of the momentum equation,

$$\sum F_x = \sum_{CS} u \cdot (\rho \cdot u \cdot A)$$

For a CV enclosing the plate and the two jets,

$$-F = u_{hole}(\rho u_{hole} A_{hole}) + u_{upper}(\rho u_{upper} A_{upper}) + u_{lower}(\rho u_{lower} A_{lower}) - u_{in}(\rho u_{in} A_{in})$$

(+6 points)

With $u_{hole} = u_{in} = 25 \frac{m}{s}$, $u_{upper} = u_{lower} = 0$, $A_{in} = \frac{\pi}{4} D_1^2$, and $A_{hole} = \frac{\pi}{4} D_2^2$,

(+3 points)

$$\begin{aligned} F &= (998)(0.0314)(25) + 0 + 0 - (998)(0.0707)(25) \\ &= 784 - 1764 \end{aligned}$$

$$\therefore F = 980 \text{ N (to left)}$$

(+1 point)