

2.135 Consider a homogeneous right circular cylinder of length L , radius R , and specific gravity SG , floating in water ($SG = 1$) with its axis *vertical*. Show that the body is stable if

$$R/L > [2SG(1 - SG)]^{1/2}$$

Solution: For a given SG , the body floats with a draft equal to $(SG)L$, as shown. Its center of gravity G is at $L/2$ above the bottom. Its center of buoyancy B is at $(SG)L/2$ above the bottom. Then Eq. (2.52) predicts the metacenter location:

$$MB = I_o / \nu_{\text{sub}} = \frac{\pi R^4 / 4}{\pi R^2 (SG)L} = \frac{R^2}{4(SG)L} = MG + GB = MG + \frac{L}{2} - SG \frac{L}{2}$$

Thus $MG > 0$ (stability) if $R^2/L^2 > 2SG(1 - SG)$ *Ans.*

For example, if $SG = 0.8$, stability requires that $R/L > 0.566$.



