Answer on Question #60554-Engineering-Material Science Engineering

A brass tie bar of length 500 mm and diameter 20 mm undergoes a change in temperature from 25°C to 135°C. The linear expansivity of copper is 19 × 10−6°C−1 and its modulus of elasticity is 84 Gpa.

i) Determine the change of length that takes place.

This part of the task provides part of the evidence for the grading criterion P8.

ii) Determine the compressive force induced in the bar if it is rigidly held and expansion is prevented.

Solution

i)

$$dl = \alpha l \Delta T = 19 \cdot 10^{-6} \cdot 500 \cdot (135 - 25) = 1.045\ mm.$$

ii)

$$F = \sigma A = \alpha T E A = 19 \cdot 10^{-6} \cdot 84 \cdot 10^{9} \cdot (135 - 25) \cdot \pi (0.01)^2 = 55.15\ kN$$