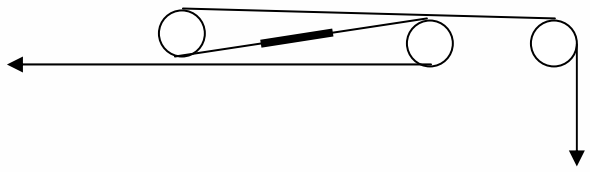
JETS Challenge 127
Light Rail Electric Cable Power

The light rail public transport system in Salt Lake City, Utah, is powered by an electric cable suspended above the tracks. The steel cable cannot be allowed to sag when the temperature changes. So every 250 m there is an expansion joint to adjust the length as the temperature changes from -15°C to 38°C. Tension is maintained by a weight and 3 sheaves as shown below. The thermal expansion is given by the equation: $\Delta = \alpha L \Delta T$ where

Δ = change in length due to thermal expansion (m)
α = thermal expansion coefficient (= $12x10^{-6}$ per °C for steel)
L = nominal length of metal (m)
ΔT = temperature difference between max and min temperatures (°C)

The Challenge: Find the maximum change in length of this cable (m) due to temperature.



$\Delta = \alpha L \Delta T$
$\alpha = 12x10^{-6}$ per °C
L = 250 m
$\Delta T = 38°C - (-15°C) = 53°C$

$$\Delta = \frac{12x10^{-6}}{1°C} \cdot (250m) \cdot 53°C$$

= 0.159m

ANSWER: 0.159m

JETS Challenge problems are generously provided by Dave Meredith, Associate Professor, Penn State University-Fayette