Estimation of Compression Force in Neoprone

Material Properties

Shore A: $H_s := 70$

Elastic modulus: $E_s := e^{\left(0.0235 \cdot H_s - 0.6403\right)} \cdot MPa = 2.731 \cdot MPa$

Geometry

Neoprene thickness: $t_n := 25 \cdot mm$

Tubular OD: $d_o := 406 \cdot mm$

Tubular wall thickness $t_t := 16.77 \cdot mm$

Depth of clamp: $H_c := 400 \cdot mm$

Contact area between neoprene and tubular: $A_c := \pi \cdot d_o \cdot H_c$

Derivation of Compression Force

Desired neoprene compression: $\Delta t := 5 \cdot mm$

Spring constant: $k_s := \frac{E_s \cdot A_c}{t_n}$

Compression force required $F_c := k_s \cdot \Delta t = 279kN$

$$\varepsilon = \frac{\Delta t}{t} = \frac{\sigma}{E} \qquad \sigma = \frac{E \cdot \Delta t}{t}$$

$$\sigma = \frac{F}{A} = \frac{E \cdot \Delta t}{t} \qquad F = \frac{E \cdot A}{t} \cdot (\Delta t)$$

$$F = k \cdot \Delta t \qquad k = \frac{E \cdot A}{t}$$