

APPENDIX5

Current leads cross sections

external current lead(1)

$$\phi_{1e} := 1.75 \cdot \text{in}$$

$$\phi_{1i} := 1.62 \cdot \text{in}$$

$$A1 := \pi \left[\left(\frac{\phi_{1e}}{2} \right)^2 - \left(\frac{\phi_{1i}}{2} \right)^2 \right]$$

$$A1 = 2.22 \cdot 10^{-4} \text{ m}^2$$

internal current lead(2)

$$\phi_{2e} := 0.75 \cdot \text{in}$$

$$\phi_{2i} := 0.62 \cdot \text{in}$$

$$A2 := \pi \left[\left(\frac{\phi_{2e}}{2} \right)^2 - \left(\frac{\phi_{2i}}{2} \right)^2 \right]$$

$$A2 = 9.024 \cdot 10^{-5} \text{ m}^2$$

VTI cross section

$$\phi := 69 \cdot \text{mm} \quad \text{VTI diameter}$$

$$A3 := \left(\frac{\phi}{2} \right)^2 \cdot \pi$$

$$A3 = 3.739 \cdot 10^{-3} \text{ m}^2 \quad \text{VTI cross section}$$

He cross section

$$A4 := A3 - A1 - A2$$

$$A4 = 3.427 \cdot 10^{-3} \text{ m}^2$$

Hidraulic diameter

Inner pipe

$$Ah1 := \frac{\pi \cdot \phi_{2i}^2}{4}$$

$$Ah1 = 1.948 \cdot 10^{-4} \text{ m}^2$$

$$Ph1 := \pi \cdot \phi_{2i}$$

$$Ph1 = 0.049 \text{ m}$$

$$Dh1 := 4 \cdot \frac{Ah1}{Ph1}$$

$$Dh1 = 0.016 \text{ m}$$

Inner pipe- outer pipe

$$Ah2 := \frac{\pi}{4} \cdot (\phi_{1i}^2 - \phi_{2e}^2)$$

$$Ah2 = 1.045 \cdot 10^{-3} \text{ m}^2$$

$$Ph2 := \pi \cdot (\phi_{1i} + \phi_{2e})$$

$$Ph2 = 0.189 \text{ m}$$

$$Dh2 := 4 \cdot \frac{Ah2}{Ph2}$$

$$Dh2 = 0.022 \text{ m}$$

outer pipe-VTI

$$Ah3 := \frac{\pi}{4} \cdot (\phi^2 - \phi_{1e}^2)$$

$$Ah3 = 2.187 \cdot 10^{-3} \text{ m}^2$$

$$Ph3 := \pi \cdot (\phi + \phi_{1e})$$

$$Ph3 = 0.356 \text{ m}$$

$$Dh3 := 4 \cdot \frac{Ah3}{Ph3}$$

$$Dh3 = 0.025 \text{ m}$$

Velocita'

$$\text{Re} := 2300$$

$$\mu := 12.5 \cdot 10^{-7} \cdot \frac{\text{kg}}{\text{m} \cdot \text{s}}$$

$$\rho := 16.89 \cdot \frac{\text{kg}}{\text{m}^3}$$

$$v1 := \text{Re} \cdot \frac{\mu}{\rho \cdot Dh1}$$

$$v1 = 0.011 \text{ m} \cdot \text{s}^{-1}$$

$$v2 := \text{Re} \cdot \frac{\mu}{\rho \cdot Dh2}$$

$$v2 = 7.703 \cdot 10^{-3} \text{ m} \cdot \text{s}^{-1}$$

$$v3 := \text{Re} \cdot \frac{\mu}{\rho \cdot Dh3}$$

$$v3 = 6.934 \cdot 10^{-3} \text{ m} \cdot \text{s}^{-1}$$