Calculate the pin pitch required to keep the maximum fuel cladding temperature in the hottest rod below $T = 820\ K$ in sodium and lead, assuming

$D_{rod} = 10.0\ mm$, $L_{fuel} = 100\ cm$.

$v_{Pb} = 1.5\ m/s$, $v_{Na} = 8.0 m/s$

P_{in} **average** linear power density $\chi_{ave} = 20 kW/m$

The core inlet temperature of $670\ K$ (stays constant during the transient)

Calculate the heat transfer coefficient at the beginning and end of the fuel rod

Calculate the vertical elevation of the decay heat removal heat exchanger (HHX) required for the cladding of the hottest rod to survive an unprotected loss of flow accident (ULOF) with lead and sodium coolants, assuming

$H_{ch} = 150 cm$,

$\mu_{Pb}(T) = 4.55 \times 10^{-4} e^{\frac{1069}{T}}$, $\mu_{Na}(T) = e^{-6.4406 - 0.3958 ln(T) + \frac{556.835}{T}}$

Decay heat average linear power density $= 1.5\ kW/m$

$\Delta T_{coolant} = 100K$, over core during natural convection conditions.

Total pressure-drop in system $= 2\Delta P_{ch}$

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Pin pitch required to keep the maximum fuel cladding temperature in the hottest rod below T = 820 K in sodium and lead where core inlet temperature is T = 670 K
Pin pitch for Na: 10.3999 mm
Pin pitch for Pb: 12.5209 mm


Heat transfer coefficient, h
For Na:
h_begin:76395.5812
h_end:65211.0421
For Pb:
h_begin:30170.1866
h_end:30927.4246

The vertical elevation of the decay heat removal heat exchanger (H_HX) required for the cladding of the hottest rod to survive an unprotected loss of flow accident (ULOF) with lead and sodium coolants,
 assuming H_ch = 150 cm
For Na:102.9894 kPa/m
For Pb:2086.6395 kPa/m
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