Assignment 4

Due on 2021-12-17, 23:59 EST.

The due date for submitting this assignment has passed.

As per the course outline, before starting the assignment:

1. 2,280 km of oil and gas lines and oil and gas heat exchanger at 20°C and loses at 4°C to exchanger heat with 90,000 m^3/hr cooling water (from 4°C heat exchanger to 4°C). Calculate the heat side heat transfer coefficient assuming finned, straight, horizontal flow, 20°C in the oil side and 4°C in the water side with 0.4 m length in a well-defined flow path arrangement. The tube velocity should be between 1.5 to 2.5 m/s.

Physical properties at average temperature:
- Specific heat: 2.08 MJ/kg K
- Thermal conductivity: 0.07 W/m K
- Density: 800 kg/m^3
- Viscosity: 0.00001 Ns/m^2

Specific heat of water: 4.18 JJ/g K

- 4°C: 4.18 JJ/g K

a) Show the calculation done above.
b) Find the area of the exchanger in m^2.
c) What is the cooling water mass flow rate in kg/h?

d) The oil side heat transfer coefficient $h_o$ can be calculated using the following expression:

$$ h_o = \frac{\mu_o \cdot C_p \cdot \Delta T}{\delta} $$

where $\mu_o$ is the viscosity of the oil, $C_p$ is the specific heat of the oil, $\Delta T$ is the temperature difference between the oil and water, and $\delta$ is the hydraulic diameter of the exchanger.

Using the given values, calculate the heat transfer coefficient $h_o$ for the oil side in the exchanger.