# Tutorial 12: Natural Circulation with two-phase flow

# Problem Description:

A uniform diameter two-phase natural circulation loop, as shown in Figure 12, with an inside diameter of 19.9 mm, is considered. The loop is filled with water and is operated at a pressure of 70 bar. Steam-water separation of 100 % can be assumed in the separator. For an inlet subcooling of 10 °C and power of 25 kW, the steady-state flow rate in the loop and steam quality at the heater exit must be estimated.

Diagram

Description automatically generated

(All dimensions are in mm)

Figure 12: Flow Circuit for Problem 3.3.3

# Results

The simulation results are given in Table 11, along with results predicted by the Flownex code [18]. It is seen that the results match very well. Thus, the code can handle open and closed loops with single-phase and two-phase natural circulation problems.

Table 11: Results for Problem 3.3.3

|  |  |  |
| --- | --- | --- |
| Results | Benchmark (Flownex code) | PINET |
| Steady state flow rate (kg/s) | 0.2901 | 0.2901 |
| Heater Exit Quality | 0.02182 | 0.02180 |