

PROBLEM SET 1 - HANDOUT

Problem 12-1

Estimate the size of the motor necessary to pump a lean oil to the top of an absorption tower operating at a pressure of 445 kPa. The oil is to be pumped from an open tank with a liquid level 3 m above the floor through 46 m of pipe with an inside diameter of 0.078 m. There are five 90° elbows in the line, and the top of the tower is 9.1 m above the floor level. A flow of 2.7 kg/s of lean oil is required. The viscosity of the oil is 15 cP, and its density is 857 kg/m³. Assume that the efficiency of the pumping system including the motor is 40%.

Problem 12-2

What is the pressure loss when 2.14 kg/s of pure benzene at 40 °C flows through a 21-m length of straight pipe with an inside diameter of 0.0409 m? The pipeline contains six 90° elbows, one tee used as an elbow (equivalent resistance equal to 60 pipe diameters), one globe valve, and one gate valve. The density of benzene is 849 kg/m³, and its viscosity at 40 °C is 5×10^{-4} Pa·s.