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2/16/2024

MET 330

Test 1 Reflection

1) The test demonstrates the course learning objective from chapter 6 of the application of Bernoulli's equation. Bernoulli's equation, which relates the pressure in a fluid to its velocity and elevation, is fundamental to fluid mechanics. In this problem, the pressure difference between the two tanks is determined by using Bernoulli's equation, along with considerations for the manometric fluid used in the manometer. This part also demonstrates the flow of fluids which is also an objective from chapter 6. The question involves calculating the required air pressure to achieve a certain flow rate of ethyl alcohol through a piping system. This requires an understanding of fluid flow principles, including pressure, flow rate, and the effects of different factors such as pipe length, temperature, and fluid properties.
2) For the first part when calculating the Reynolds number, I used the wrong value of dynamic viscosity for ethyl alcohol leading me to get the incorrect value for the Reynolds number and in turn leading me to get the incorrect friction factor as well. For future tests I will make sure to double check the values I am plugging in and pay close attention in order not to confuse it with any other value. Also, when calculating the head loss, I did not account for the other losses of H_{Lent}, $H_{Lelbows}$, and $H_{Lvalve.}$ Instead of taking each loss and adding them together I calculated it all as one leading me to get the incorrect value for total H_L. In the future I will draw better diagrams in order to help me better identify these losses so I can calculate them correctly. Subbing in the correct H_L value of 129.9414 into Bernoulli's equation, now gives me the correct answer valve for P_1 of 94.47 which matches the one found in the test solutions. For the manometer reading, I used the incorrect equation and process to get "h". Instead, I should have found P_3 first by using Bernoulli's equation and first finding the new (H_L) value for the energy losses up to that point which includes 74ft of pipe, one and a half elbows, the valve, and the tank entrance. This comes out to a value of 90.083ft for H_{L1-3}. Using this new value for the energy losses I can now use Bernoulli's equation to calculate P_3 which is equal to 53.566psig. Then, I should've manipulated the gamma*h equation so I can solve for h (manometer reading) getting the following equation:

$$h = \frac{\left[\left(P_1 - P_3\right) - \gamma_{alc} \times 20ft\right]}{\left(\gamma_{Hg} - \frac{\gamma_{alc}}{2}\right)}$$

After getting equation all that is left is to plug in the values and solve for h, which gives me a value of h= 5.91ft. In the future to better prepare for tests I should solve practice problems everyday so I can be better prepared and know the correct process to follow.

For Part 2 , in order to find the new manometer reading at the moment there is no flow I should have again used the equation:

$$h = \frac{\left[\left(P_1 - P_3\right) - \gamma_{alc} \times 20ft\right]}{\left(\gamma_{Hg} - \frac{\gamma_{alc}}{2}\right)}$$

Plugging in the values into the equation gives me the new manometer reading of h=0ft when there is no flow.

For Part 3, I plotted the pressure vs flow rate curve on the graph and used the equation of the line to get the flow rate (Q) at 75psi. This led me to get the incorrect answer, instead I should have plotted the flow rate value from 0-250 in increments of 25 and observed the graph at 75psi in order to see the corresponding flow rate value at that point which is roughly 190gpm. For future tests to avoid mistakes like this, I will take a refresher on excel to better my understanding of the program.

3) Writing Rubric:
   a. Purpose - 0.0/10.0 out of 0.5/10.0
   b. Drawings - 0.5/10.0 out of 1.0/10.0
   c. Sources - 0.0/10.0 out of 1.0/10.0
   d. Design Considerations – 0.0/10.0 out of 1.0/10.0
   e. Data & Variables – 0.5/10.0 out of 0.5/10.0
   f. Procedure – 0.5/10.0 out of 2.0/10.0
   g. Calculations – 1.0/10.0 out of 2.0/10.0
   h. Summary – 0.0/10.0 out of 0.5/10.0
   i. Materials – 0.0/10.0 out of 0.5/10.0
   j. Analysis – 0.0/10.0 out of 1.0/10.0
   k. Total = 2.0/10.0 out of 10.0/10.0

   1st Part:
   l. Bernoulli's at liquid surfaces and solve for air pressure - 1/7 out of 1/7
   m. Compute velocity with Q=VA - 1/7 out of 1/7
   n. Compute energy losses (pipe and minor) – 0.5/7 out of 1/7
   o. "gamma*h" equation and solve for "h" in manometer - 0/7 out of 1/7
   p. Compute pressure at 2nd elbow - 1/7 out of 1/7
   q. Create spreadsheet with all calculations 1/7 out of 1/7
   r. Correct results? – 0/7 out of 1/7
   s. Total = 4.5/7

   2nd Part
   t. "gamma*h" equation and solve for air pressure - 1/3 out of 1/3
   u. "gamma*h" equation and solve for "h" in manometer – 0.5/3 out of 1/3
   v. Correct results? – 0.5/3 out of 1/3
   w. Total = 2/3 out of 3/3

   3rd Part
   x. Use spreadsheet from "1st part" to get P1 for diff Q - 1/4 out of 1/4
   y. Plot P1 vs Q – 1/4 out of 1/4
   z. Read Q for P1=75 psig - 1/4 out of 1/4
   aa. Correct results? - 0/4 out of 1/4
   bb. Total = 3/4 out of 4/4

   Final Grade: 2+(80/3)*(4.5/7 + 2/3 + 3/4) = 56.9

4) In completing the test, one potential issue could be ensuring accuracy in both hand calculations and Excel spreadsheet solutions. Troubleshooting this involves double-checking formulas, input values, and cell references in the spreadsheet to match the hand calculations. To complete this test, I would first analyze each question to understand the requirements and concepts involved.

Then, I would perform hand calculations to solve the given problems, ensuring accuracy and proper units. Next, I would create an Excel spreadsheet to replicate the calculations, verifying that the solutions match. Going forward I would probably change the way approached the test by tackling similar tasks together, such as completing hand calculations and excel solutions for all questions related to pressure calculations before moving on to manometer readings. I learned concepts related to pressure calculations, fluid flow rates, minor losses, and the use of manometers in fluid mechanics. Additionally, I learned how creating excel spreadsheets to solve fluid mechanics problems can enhance my skills in data analysis and visualization. Engineers use these concepts in various fields such as hydraulic engineering, HVAC systems design, chemical engineering (e.g., fluid transport in processing plants), and aerospace engineering (e.g., fuel system design in aircraft). I would use the knowledge gained from this test in practical engineering scenarios involving fluid systems design. The ability to analyze pressure-flow relationships and interpret manometer readings accurately is valuable in many engineering applications. I felt most successful in solving the pressure calculations using Bernoulli's equation. I also slightly improved my skills in creating excel spreadsheets for problem-solving. The content of this course directly intersects with my field or career in engineering, particularly if I specialize in fluid dynamics, hydraulics, or thermal systems. I would estimate spending several days and numerous hours on this test and as far as organization I was all over the place, jumping from part to part if I felt that I had something off that would mess up the whole test. To improve efficiency, I would focus on further improving my excel skills to streamline the process of creating and verifying solutions in the future.