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DETERMINATION OF ENERGY LOSSES IN PIPE FITTINGS OF A FLOW WITH VARIATION OF REYNOLD NUMBER

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ABSTRACT

The total energy loss in a pipe system is the sum of the major and minor losses. Major losses are associated with frictional energy loss that is caused by the viscous effects of the fluid and roughness of the pipe wall. Energy losses also will effected when the waterway changes abruptly. The method used is to identify and differentiate the fitting conditions that reduce energy losses the most. Energy losses occur due to various factors such as pipe diameter, pipe surface roughness, and even pump strength. After knowing these factors, a more detailed study can be done. this study also intends to look at the energy losses in a flow pipe fitting as the Reynold number changes and to investigate the impact of energy losses in various pipe fittings. The experiment performed in the workshop using pvc pipes and low energy pumps suitable for medium sized equipment. Water will be routed to each connected pipeline and the valves of the other pipelines will be closed so as not to interfere with the recording of readings on the manometer. Knowledge gained from the definition, energy losses will be reduced if water passes through a larger pipe. However, with various pipe conditions, the variation of energy loss will be recorded and recorded in the data table so that comparisons are easier to make. From this experiment, We know that the area of the pipe will effected the velocity and causes the changes of the energy losses. Lastly, the experiment is success to determine the energy losses in pipe fitting by Reynold number.

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CHAPTER 1

INTRODUCTION

1.1 Background of Study

The pipe is a closed conduit, normally of round section, used for wearing fluids beneath neath strain. The pipe going for walks in part-whole, in any such case, atmospheric strain exists in the pipe, additionally. The pipe's expertise is primarily based on the expected fluid glide standards. When a natural (viscous) fluid flows via a pipe, some of its power is spent preserving the glide. Energy losses in pipes used to transport fluids are basically because of friction, in addition to the various singularities encountered. These losses are typically transformed into head discounts withinside the course of the glide. Due to inner friction and turbulence, this power is transformed into thermal power. Such a conversion ends in expressing the power loss in phrases of the fluid peak termed the top loss and commonly categorized into categories. Because of friction, the primary kind is known as linear or primary head loss. It is a gift in the course of the duration of the pipe. The 2d class known as minor or singular head loss is because of the minor appurtenances and add-ons found in a pipe network. In general, power or head losses on pipe consisted of primary power losses because of friction and minor power losses because of unexpected pipe expansion, unexpected pipe contraction, bend in the pipe, an obstruction in pipe, and pipe fittings **(Sunaris et al., 2019).**

Therefore, Pipelines are one of the most cost-effective ways to move liquids. The process industries are commonly utilized to transport water, fuels, and other fluids. Pipeline monitoring entails measuring pressures and flow rates at various places along the pipeline, most notably at the pipeline's ends (Lahiouel & Lahiouel, 2015). Changes in hydraulic variables, particularly pressures, enable the detection of system disturbances and failures, such as blockages and leaks, as well as the development of control loops that allow for the regulation or adjustment of the operating point. The modest head losses due to the fittings were not considered because the experimental pipe utilized in this study is essentially straight. As a result, fittings and valves minimally influence the total pressure drop in the pipeline. As a result, pressure losses caused by fittings, valves, and other constraints are typically classified as "small losses" and ignored in such situations. However, in shorter pipes, the pressure loss in valves, fittings, and other components can account for a significant portion of overall pressure loss. Hence, these must be factored into engineering calculations. Therefore, it is necessary to know the head loss coefficients (for local losses, accessories, and valves) and the roughness coefficients related to friction (for distributed losses in the entire pipeline) **(Santos-Ruiz et al., 2020)**.

During the design of the piping system, it may be sufficient to know the nominal value of the roughness and head loss coefficients provided by the manufacturer. For a pipeline of small length having many minor appurtenances, the total minor head loss can be greater than the frictional head loss. However, in petroleum and water distribution networks, the pipelines are of considerable length; therefore, the terms significant head loss and minor head loss can be used without confusion. The friction coefficient is a function of the flow regime characterized by the Reynolds number. Several explicit and implicit relationships were proposed for the friction coefficient. Extensive experimentations involving smooth and artificially roughened pipes were achieved using sand particles of uniform size. **(Lahiouel & Lahiouel, 2015)**.

One example is The first offshore pipeline was born in Summerland. Since then, the offshore pipeline has become the unique means of efficiently transporting offshore fluid, i.e., oil, gas, and water. These pipelines can be made of commercial materials such as steel, iron, and concrete or plastic materials such as polyvinyl chloride and high-density polyethylene (HDPE). Tas et al. reported that the HDPE pipes had become one of the most extensively used plastic materials in water supply systems. The design of an offshore HDPE pipeline requires a comprehensive energy loss analysis. **(Tas et al., 2020)**. There are many problems associated with pipe flow, whether the fluid is in rest or motion. Frictional losses are commonly encountered in transporting fluid from one place to another through the pipes. When a fluid moves, energy is dissipated due to friction; turbulence dissipates even more energy for high Reynolds number flows. **(Patel et al., 2019)**

1.2 Problem Statements

The diameter of the pipe is a problem **(Kade Champbell, 2017)** because the small pipe diameter will cause high energy losses. There are many other problems, such as pipe material and other factors about the pipe. Also, The amount of energy lost depends on several factors such as the fluid's speed and viscosity. Common Major losses are associated with frictional energy loss caused by the viscous effects of the medium and roughness of the pipe wall. On the other hand, minor losses are due to pipe fittings, changes in the flow direction, and changes in the flow area. On the other hand, the pipe's durability and rigidity to handle the pressure generated by water or gas becomes an issue in the long run **(Brandt et al., 2017)**.

This can result in tragedies like burst pipes and holes. It's also important to consider the best approach for fixing the pipe and the amount of time it'll take. This must be determined to determine the pipe's material and condition and complete a project or study. Furthermore, because this experiment is carried out slowly, more calculations must be carried out to be used in reality without causing destruction. Another standard error in an experiment is a human error while doing the experiment or taking data and consideration plus-minus parallax or application errors. in general, the fittings to be used have an angle because the condition of the channel that changes direction suddenly will give a reading of energy losses significantly. **(Lahiouel & Lahiouel, 2015)**.

However, this study is reserved for the daily use of the public at home, in small premises, or in places that commonly use PVC pipes. The plumber or community will better understand the most suitable pipe flow to use. The Time taken for each flow of pipe will be measured for a better reference. This experiment determines the energy losses in pipe fitting of a flow with a variation of Reynold number.

1.3 Objectives

i. to investigate the energy losses in pipe fitting of a flow with variation of Reynold number
ii. to analyse the effect of the energy losses in different pipe fitting.