Table of Contents

[INTRODUCTION 2](#_Toc404744141)

[PROPERTIES OF THE PIPES 2](#_Toc404744142)

[CALCULATIONS 2](#_Toc404744143)

[DISCUSSION OF RESULTS 3](#_Toc404744144)

APPENDICES

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# INTRODUCTION

The measurement of the discharges and the energy losses through the parallel pipes can be done in the laboratory. Investigation of the energy loss throughout the parallel connected two pipes, one of them has two bends in which result minor losses, are done in this laboratory session. The crucial point of the experiment is that two parallel pipes have the same amount of head losses. In the light of this equality, discharges in pipes are obtained by a number of iterations.

# PROPERTIES OF THE PIPES

The properties of pipes and their calculated areas are shown in the **Table-1.**

Table 1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Pipe No. | Material | ε (mm) | D (m) | Area (m2) | Length (m) |
|
| E | Steel | 0.045 | 0.05 | 0.001963495 | 4.05 |
| F | Steel | 0.045 | 0.02 | 0.000314159 | 4.4 |

# CALCULATIONS

All calculations related to the task I&II are attached to the end of the report. Here is the overview of the iteration table.

Table 2: Iteration Table

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Iteration Number** | **fE** | **fF** | **VE** | **VF** | **QE (m3/s)** | **QF (m3/s)** | **ReE** | **ReF** | **fE** | **fF** |
| 1 | 0.01913 | 0.02416 | 0.24494 | 0.12433 | 0.000480941 | 0.000039059 | 12247.07277 | 2486.54625 | 0.03098 | 0.04947 |
| 2 | 0.03098 | 0.04947 | 0.24648 | 0.11472 | 0.000483958 | 0.000036042 | 12323.89707 | 2294.48549 | 0.03094 | 0.05073 |
| 3 | 0.03094 | 0.05073 | 0.24669 | 0.11339 | 0.000484377 | 0.000035623 | 12334.57129 | 2267.79993 | 0.03093 | 0.05092 |
| 4 | 0.03093 | 0.05092 | 0.24672 | 0.11320 | 0.000484439 | 0.000035561 | 12336.12880 | 2263.90615 | 0.03093 | 0.05095 |
| 5 | 0.03093 | 0.05095 | 0.24673 | 0.11317 | 0.000484448 | 0.000035552 | 12336.35769 | 2263.33395 | 0.03093 | 0.05095 |

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# DISCUSSION OF RESULTS

In this experiment, discharges of the two parallel pipes are calculated by 5 iterations. Before the iterations, since the total discharge of the two pipes is known, the relation between QE and QF are found in terms of fE and fF. To do that, head loss equality of the parallel pipes is used and the frictional loss of pipe E is equated to the friction and minor losses of the pipe F. In this equality, relation between QE and QF are discovered. After that, the flow is assumed to be completely rough flow and Swamee-Jain equation is adjusted according to completely rough flow. Initial value of the friction factors of the pipes E&F are calculated and iterations are done which is shown in the calculation part.

Table 3: Calculated results are shown in red, the rest is measured values

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CALCULATED&MEASURED RESULTS** | | | | |
|
| QE (m3)/s | QF (m3/s) | QT (m3/s) | HU/S-1 (m) | HD/S-2 (m) |
|
| 0.00048 | 0.00004 | 0.00052 | 0.408 | 0.401 |

The sum of the discharges in the pipes E&F are equal to the 0.00052, which is the measured value in the laboratory session. Moreover, as it is expected, HU/S-1 (m) is larger than HD/S-2 (m) because water flows from E1 to E2. That is, piezometric head of the upstream should be larger than the piezometric head of the downstream in this case, because of the equality of the velocity head (diameter is constant).

Because of the round-off errors, there may be some mistakes, but since the values are matched these errors are so small and they can be ignored according to the engineering point of view.