pipeFLOW®

taking the pressure out of fluid flow calculations

Liquid Pipe Length

Verification of Calculation Results
For Non-Compressible Flow

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Introduction

Pipe Flow Liquid Pipe Length is a software application that calculates the maximum length of a pipe for a given flow rate at an allowed pressure drop using the Darcy Weisbach equation with Colebrook-White friction factors. The software takes in to account pipe friction losses, the pipe material, internal roughness of the pipe, the specified flow rate, the maximum allowed pressure drop, the loss through any fittings, bend, and valves, the fluid density, and the fluid viscosity.

The liquid pipe diameter calculations produced by the Pipe Flow Liquid Pipe Length software can be verified by comparison against published results from a number of well-known sources. The information in this document provides a general description of a published problem, the **Reference Source**, the **Published Results Data**, the **App Results Data** and a commentary on the results obtained.

For each of the calculation problems detailed in this document, the results data produced by the **Pipe Flow Liquid Pipe Length software compares well with the published results data.**

Calculations

Friction Factors are calculated using the **Colebrook-White** equation.

Friction Loss for non-compressible fluids is calculated using the **Darcy-Weisbach** method, which provides accurate results for Newtonian fluids, including general process fluids.

Software Releases

The Pipe Flow Liquid Pipe Length App is currently available only on iOS (Apple Mobile Devices).

Pipe Flow Software produces a range of different software applications for calculating flow rates and pressure losses in pipe systems, including our premier Pipe Flow Expert software for Windows, which is used to design energy efficient piping and pumping systems.

Pipe Flow Software programs are used by engineers in over 100 countries worldwide.

We have clients in a variety of industries including aerospace, chemical processing, education, food and beverage, general engineering, mining, petrochemical, pharmaceutical, power generation, water distribution, and wastewater processing.

Case 01: Length of Steel Water Pipe

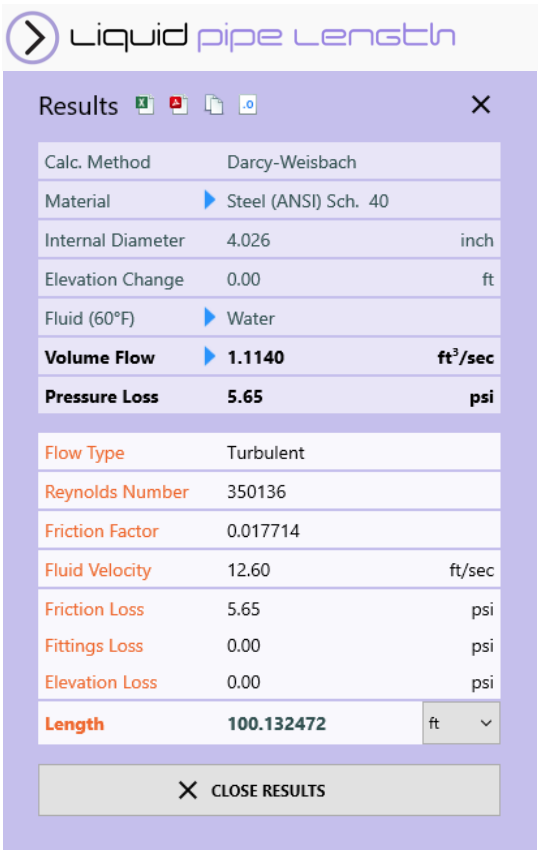
Reference: Flow of Fluids – Technical Paper No 410, 1988, Crane Co. Page B-14

Liquid Pipe Length App: Find_Length_Case_01_Water_Steel_Pipe.pfwl

Calculation Problem:

A nominal 4 inch steel sch. 40 pipe carries water with a flow rate of 1.1140 ft^3/sec and velocity of 12.6 ft/sec.

If the pressure drop is given to be 5.65 lbs/$inch^2$, what is the length of pipe?



Fluid Data: Water at 60°F

Commentary:

See the Results Comparison Table below.

The published data and the calculated results compare well.

Results Comparison:

Data Item	Published Data	App
Length (ft)	100	100.132

Case 02: Water Pipeline length

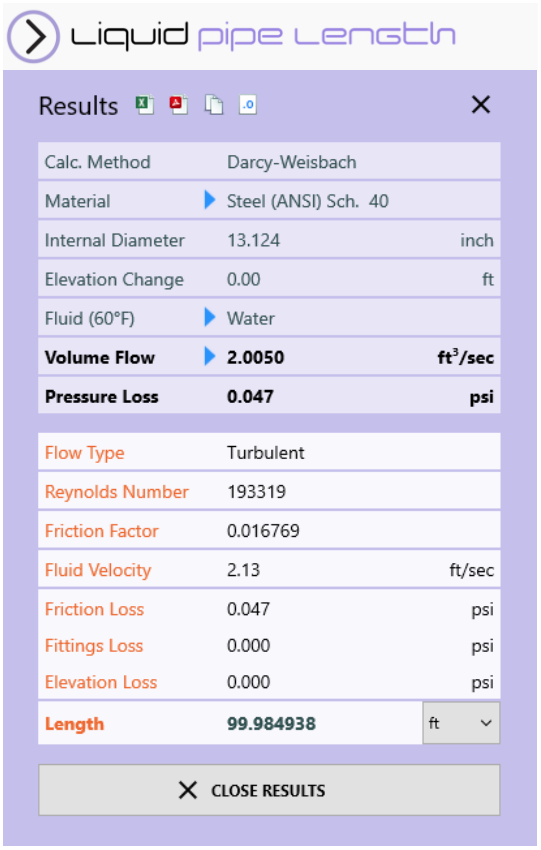
Reference: Flow of Fluids – Technical Paper No 410, 1988, Crane Co. Page B-14

Liquid Pipe Length App: Find_Length_Case_02_Water_Steel_Pipe.pfwl

Calculation Problem:

A nominal 14 inch steel sch. 40 pipe carries water with a flow rate of 2.005 ft^3/sec and velocity of 2.13 ft/sec.

If the pressure drop is given to be 0.047 lbs/$inch^2$, what is the length of pipe?



Fluid Data: Water at 60°F

Commentary:

See the Results Comparison Table below.

The published data and the calculated results compare well.

Results Comparison:

Data Item	Published Data	App
Length (ft)	100	99.99

Case 03: Pipeline Between Two Reservoirs with Fittings

Reference: Nalluri & Featherstone's Civil Engineering Hydraulics sixth edition, 2016
Martin Marriott, Page 96, Example 4.2

Liquid Pipe Length App: Find_length_Case_03_Reservoir_Pipeline_Fittings.pfwl

Calculation Problem:

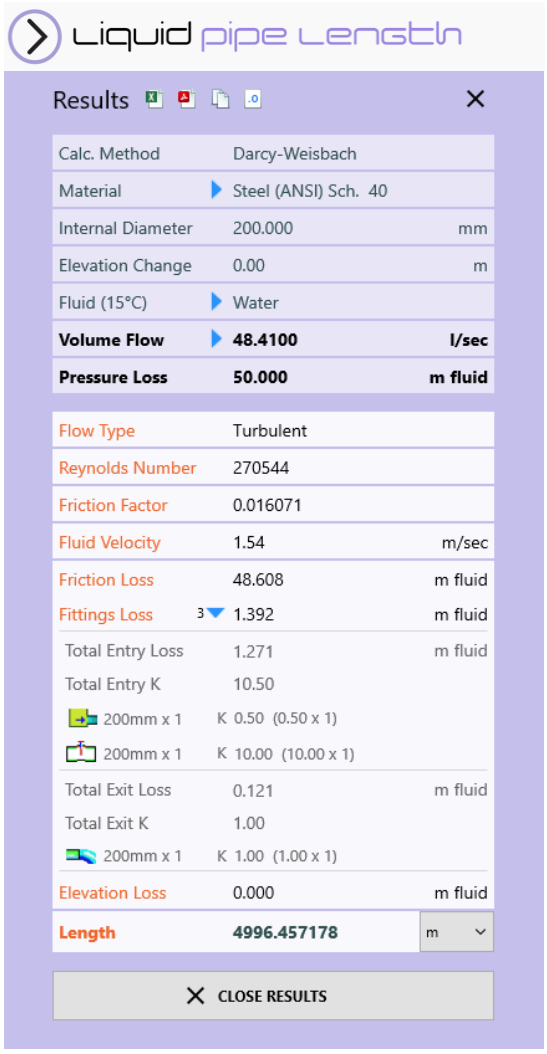
A uniform, 200 mm diameter pipeline with an internal roughness of 0.03 mm, conveys water at 15°C between two reservoirs with a flow rate of 48.41 L/s.

The difference in water level between the reservoirs is 50 m.

There is an entry head loss of $0.5V^2/2g$, a valve with a head loss of $10V^2/2g$ and a velocity head of $\alpha V^2/2g$, where $\alpha = 1.0$.

Calculate the pipe length required.

Fluid Data: Water at 15°C.



Commentary:

See the Results Comparison Table below.

The published data and the calculated results compare well.

This published problem states the length of pipe and uses this to calculate the steady discharge between the reservoirs, and this is only given to two decimal places.

The App used the given discharge flow rate and the given head loss data to calculate the length of pipe that produced these conditions.

Results Comparison:

Data Item	Published Data	App
Length	5000 m	4996.5 m

References

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