pipeFLOW®
taking the pressure out of fluid flow calculations

www.pipeflow.com

Pipe Flow Wizard
For iOS

Fluid Flow and Pressure Loss Calculations Software

User Guide

iOS

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1 Introduction

Pipe Flow Wizard is a multi-platform software application that can perform calculations to find the pressure loss, flow rate, diameter or length for a single pipe.

Four separate calculation panels allow the user to easily specify the known information, calculate the answer and then generate Excel or PDF reports.

The Pipe Flow Wizard software has an intuitive interface that is consistent across platforms thereby making it easy for users to perform their calculations and share the results regardless of the device being used.

The software is backed up by an unrivalled support service that provides help to users when they need it.

1.1 Pipe Flow Wizard Software Overview

Pipeline systems range from single pipelines to very large complex networks with hundreds of interconnecting pipes. They may be simple, carrying water from one reservoir to another reservoir, or they may be complex with many interconnecting pipes that distribute fluid over a large area, or they could fall somewhere in-between such as a system that transfers a fluid from a supply container to a delivery point.

The Pipe Flow Wizard software is designed to calculate pressure loss, flow rate, diameter size, or length, for a single pipe. It is a useful tool for piping calculations that engineers often need to perform either at the office or out in the field (perhaps to work out a required pump head, or to check an expected flow rate or pressure drop).

Note: Our *Pipe Flow Expert* software can be used to model and calculate flow rates, pressure losses and pumping requirements within a complex pipe system.

Each Pipe Flow Wizard calculation panel has a set of data input fields that enable the known information to be entered. This data typically includes:

- The internal size, roughness and length of the pipe.
- The elevation change between the start and end of the pipe.
- The type, quantity and position of fittings on the pipe.
- The type and characteristics of the fluid in the pipe.

Once the known information has been specified for the required calculation, the results can be obtained by tapping Calculate. The results panel slides up and over the inputs panel to concisely display the calculated data which typically includes:

- Friction losses, fitting losses, elevation change gains / losses.
- Flow type, Reynolds number and Friction factor.
- Entry and exit pressures and densities.
- Entry and exit flow rates.
- Total pressures loss.

1.2 Device Compatibility

Requires iOS 8.0 or later.

Please see the Compatibility section of Pipe Flow Wizard in the App Store for a full list of compatible devices.

Note:

The device must be 64 bit and for best user experience we would recommend running on one of the later iPhone or iPad devices, however the Pipe Flow Wizard App should operate well on iPhone version 6 or later (and can even be run on iPhone 5s).

1.3 Licensing Information

Pipe Flow Wizard for iOS is a software package that is provided for use on Apple iOS devices.

Installation

When the software is installed from the App Store, it can be used in Trial Mode.

When in Trial Mode, calculations can be performed subject to the following restrictions:

- Find Pressure - Pipe Diameter cannot be changed.
- Find Flow - Pipe Diameter cannot be changed.
- Find Diameter - Pipe Length cannot be changed.
- Find Length - Pipe Diameter cannot be change.
- The Gas Data Calculator cannot be used to compute the properties of compressible fluids at different temperatures and pressures.
- Excel & PDF reports that were produced with a licensed version of the software cannot be viewed.

To enable the above functionality, the software must have a valid Subscription.

To purchase a subscription, tap the **Buy** button BUY in the footer to display the **Subscriptions** screen, then choose the required subscription.

Figure 1 License Software

Purchasing a Subscription

Subscriptions are entirely managed by Apple Inc. Subscriptions will be charged to your iTunes Account at confirmation of purchase. Subscription automatically renews unless auto-renew is turned off at least 24 hours before the end of the current period.

You require an internet connection when licensing the software. The software does not need an internet connection to operate.

Manage Subscription

If your subscription expires, Pipe Flow Wizard will return to trial mode.

To renew your subscription, go to **Subscriptions** on your device. For more information on subscriptions and purchases, see:

https://support.apple.com/billing

Additional Devices

The Pipe Flow Wizard software can be downloaded to all your compatible Apple devices.

If you have purchased a subscription, then this subscription is valid on all compatible Apple devices that share the same Apple ID.

To enable a subscription on another device:

Launch Pipe Flow Wizard and tap Settings > Subscriptions > Restore Purchases

Summary

- The Pipe Flow Wizard software can be downloaded and installed for a free trial.
- A subscription can be purchased via the Apple App Store that will enable use of the software for a period of time (e.g. 3 months, 12 months).
- A user can be up and running with a licensed version of the software within a few minutes.
- Software support and maintenance, including technical assistance, help with modeling issues and free upgrades to new releases, are provided for free while you are running a licensed copy of the Pipe Flow Wizard software. This ensures that you will always be able to use the latest version of the software.

1.4 Contacting Pipe Flow Software

Email: *wizard@pipeflow.com*

Internet: *www.pipeflow.com*

UK Telephone: +44 (0)161 408 3569

USA Telephone: +1 650-276-3569
+1 650-276-FLOW

Pipe Flow Software, PipeFlow.com and PipeFlow.co.uk are trading names of Daxesoft Ltd, a U.K. Registered Company.

1.5 Additional Pipe Flow Software Programs

The Pipe Flow Wizard software is also available for Windows and Mac OS.

Additional Microsoft Windows based software:

Pipe Flow Expert - for designing piping and pumping systems

Pipe Flow Expert can be used to model pipe systems with just a few pipes through to more complex systems with many hundreds of pipes, with multiple supply points, multiple discharge points, and multiple pumps running in series or in parallel.

For more information about Pipe Flow Expert, see:

www.pipeflow.com/pipe-flow-expert-software

Pipe Flow Advisor - for Channels and Tanks

Pipe Flow Advisor may be used to estimate water flow rate from various shaped channels and tanks. It can calculate:

- Open Channel Flow
- Water Flow Rates
- Time taken to empty tanks
- Volume, Capacity, Weight and Expansion

For more information about Pipe Flow Advisor, see

www.pipeflow.com/pipe-flow-advisor-software

All software program can be downloaded for a free trial by visiting:

www.pipeflow.com

Once you have installed a trial version of one of our software products it can be fully enabled and licensed by buying a license code from our web site. You can be up and running with a fully licensed program within just a couple of minutes.

2 Interface and Menus

This section details the different features of the Pipe Flow Wizard interface. For each feature, there is an explanation, a screen shot and a table providing descriptions for each element of the feature. The following sections provide instructions for using the Pipe Flow Wizard application.

Figure 3 Calculation Panel Interface

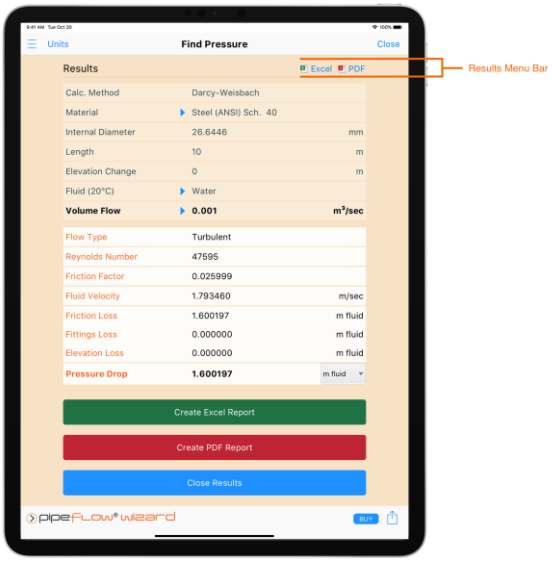


Figure 2 Results Panel Interface

2.1 Main Menu

Tap the **Main Menu** button to display the Pipe Flow Wizard main menu.

The main menu has eight different sections to help you navigate and work in Pipe Flow Wizard.

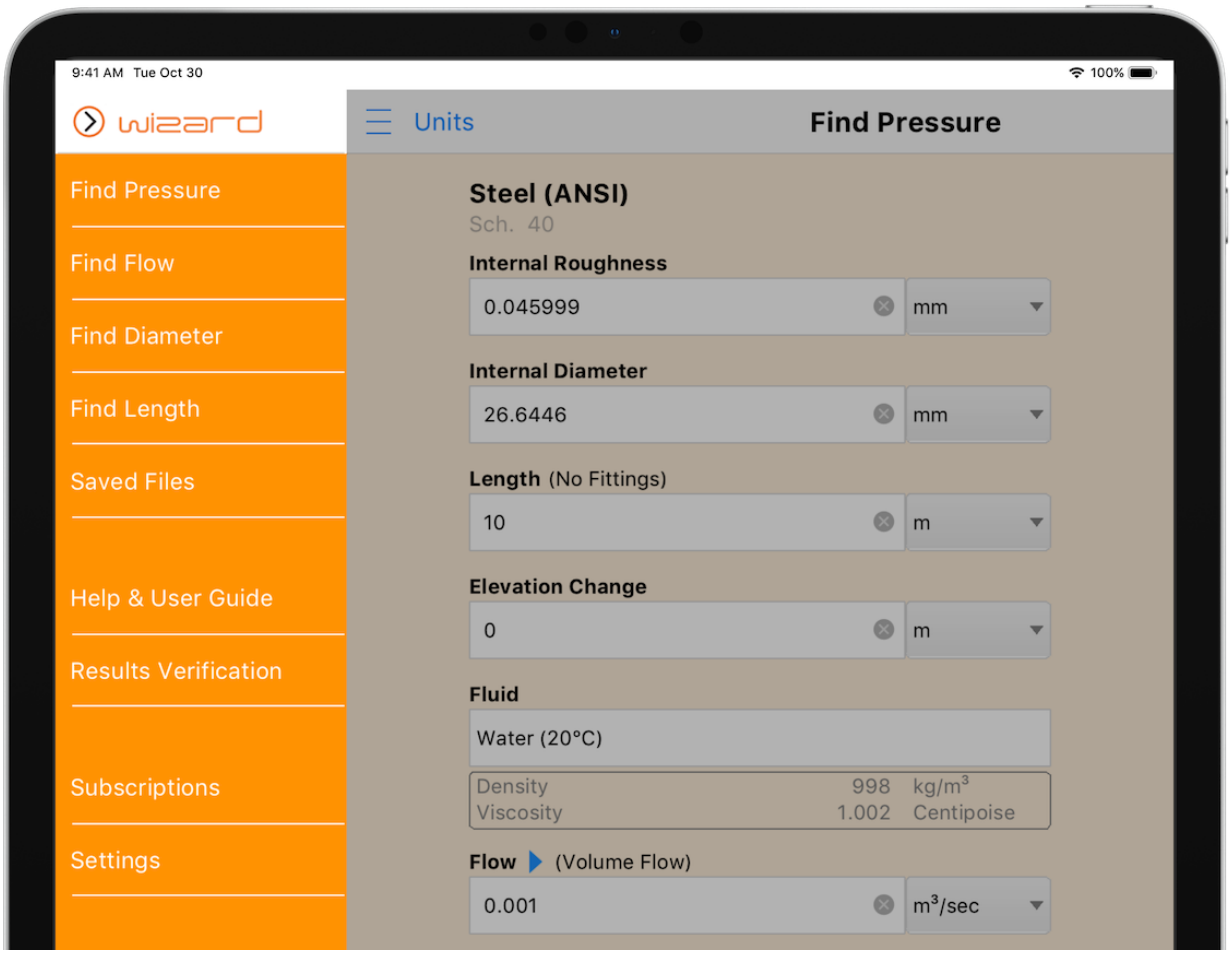


Figure 4 Main Menu

Menu Items	Description
Find Pressure	Display the **Find Pressure** calculation.
Find Flow	Display the **Find Flow** calculation.
Find Diameter	Display the **Find Diameter** calculation.
Find Length	Display the **Find Length** calculation.

Menu Items	Description
Saved Files	Display the **Saved Files** screen. For more information, see: Saved Files.
Help & User Guide	Displays the **Help & User Guide** menu. For more information, see: Help & User Guide Menu.
Results Verification	Display the **Results Verification** menu. For more information, see Results Verification Menu.
Subscriptions	Display the **Subscriptions** or **Subscription Options** screen. For more information, see Licensing Information.
Settings	Display the **Settings** menu. For more information, see Settings.

Select an option from the menu or tap the Wizard logo to close the menu.

2.1.1 Help & User Guide Menu

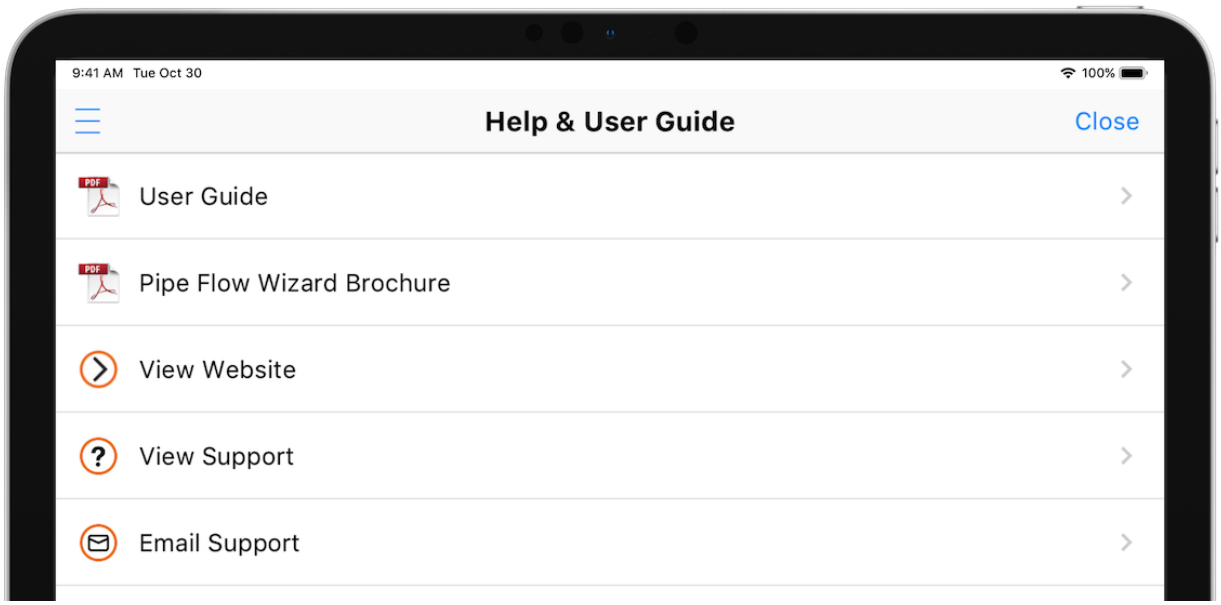


Figure 5 Help & User Guide

Menu Items	Description
User Guide	Open the User Guide PDF document (this document).
Pipe Flow Wizard Brochure	Open the Pipe Flow Wizard PDF Brochure.
View Website	Open the Pipe Flow website.
View Support	Open Pipe Flow Wizard's support pages on the web.
Email Support	Send an e-mail to our support team.

2.1.2 Results Verification Menu

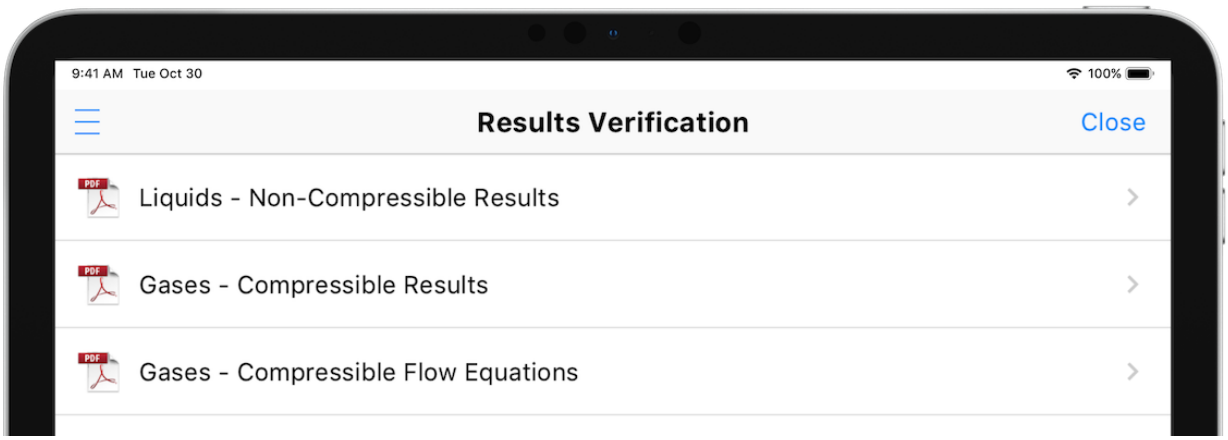


Figure 6 Results Verification Menu

Menu Items	Description
Liquids – Non-Compressible Results	Open the Non-Compressible (Liquids) Calculation Results Verification PDF document.
Gases – Compressible Results	Open the Compressible (Gases) Calculation Results Verification PDF document.
Gases – Compressible Flow Equations	Open the Compressible (Gases) Flow Equations & formula descriptions PDF.

2.2 Calculation Navigation

Each calculation can be navigated to by one of two methods:

1. Tap the name of the required calculation on the Main Menu, or
2. Swipe left / right on a Calculation Panel or Results Panel.

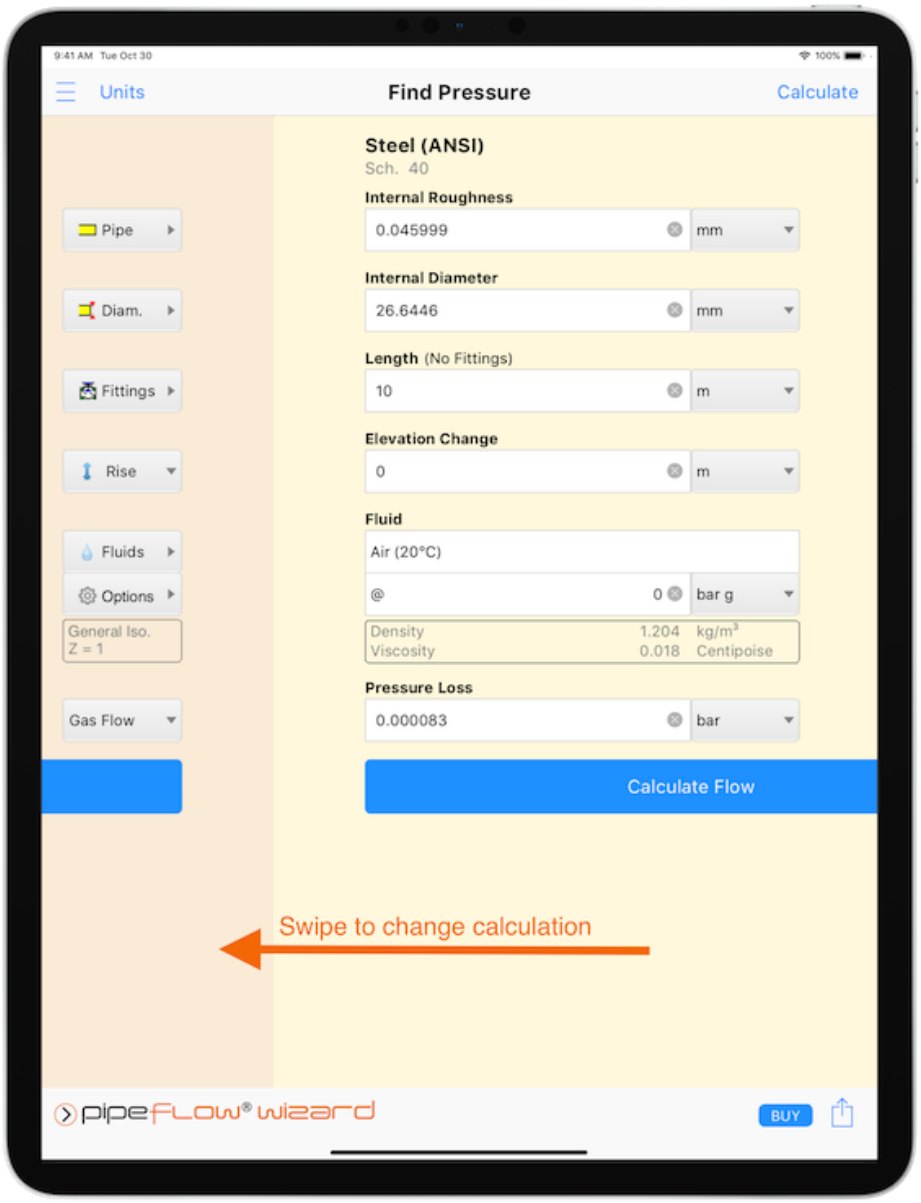
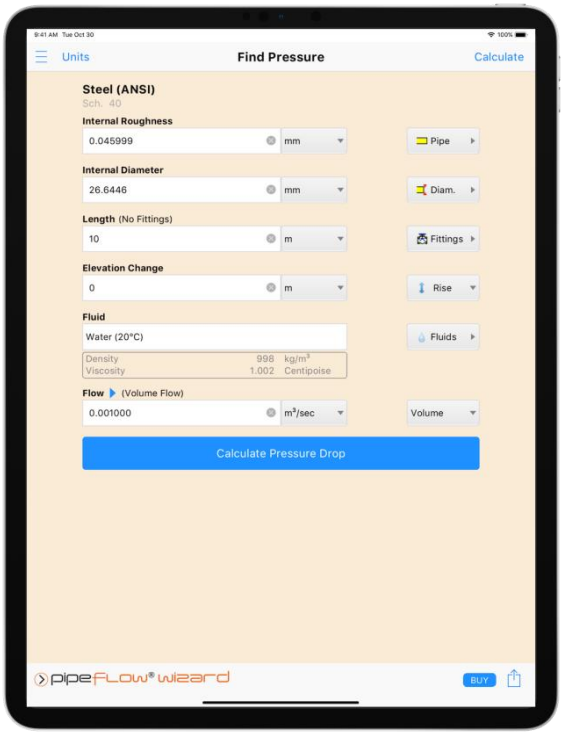


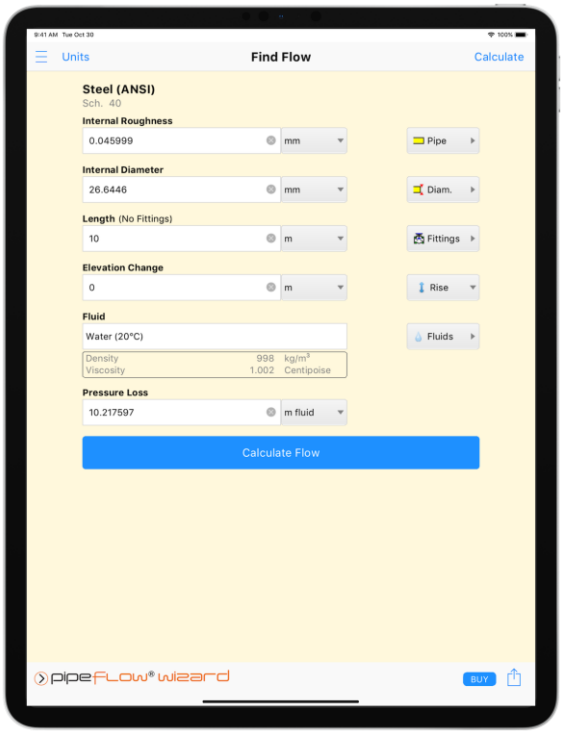
Figure 7 Calculation - Swipe Navigation

2.3 Calculation Panel

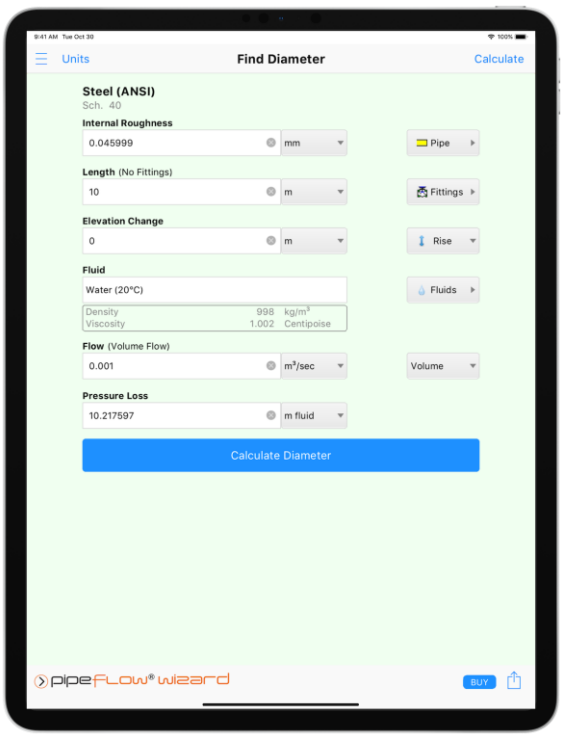
Each calculation has its own colored calculation panel.



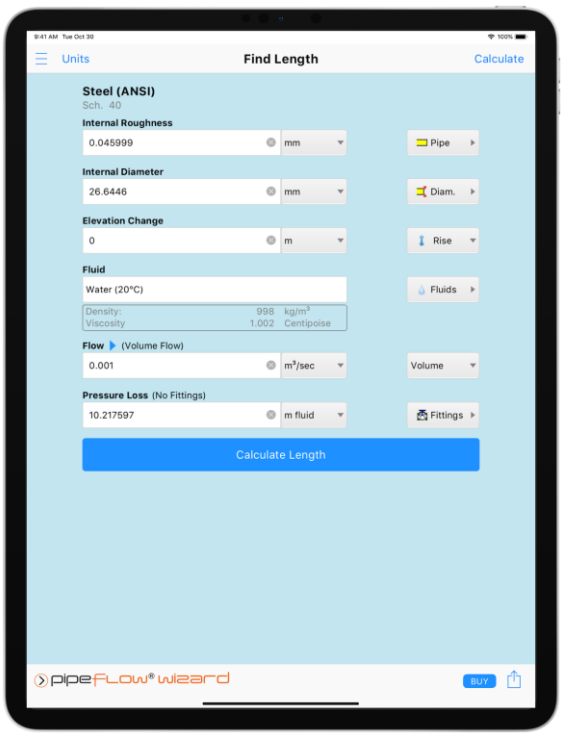
Find Pressure



Find Flow



Find Diameter



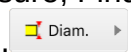
Find Length

Figure 8 Calculation Panel

The calculation panel allows you to enter known information for the required calculation:

The **Material name**, **Schedule** and **Internal roughness** of the pipe can be specified by tapping the **Pipe** 

button to open the **Pipe Material** screen from where a material can be selected from the database or a new material defined. For more information about working with pipe materials, see: Pipe Material & Diameters.

The **Internal diameter** (for Find Pressure, Find Flow and Find Length) of the pipe can be specified by tapping the **Diam.** 

button to open the **Pipe Diameter** screen from where a pipe size can be selected from the database or a new size defined. For more information about working with pipe diameters, see: Pipe Material & Diameters.

Fittings can be added to the pipe by tapping the **Fittings** 

button to open the **Fitting Screen** from where fittings can be selected, or new fittings defined. For more information about working with fittings, see: Fittings & Valves

The pipe's **Elevation** change can be specified by entering the difference in height from the start of the pipe to the end of the pipe in the **Elevation Change** field and specifying whether this is a rise or fall.

The **Fluid** in the pipe can be specified by tapping the **Fluids**

button to display the Fluid Database Action Sheet from where either the Liquids or Gases database can be opened. For more information about working with fluids, see: Fluids Database.

The **Flow** rate (For Find Pressure, Find Diameter and Find Length) of the fluid can be specified by entering the value into the **Flow** field or tapping the expander  button (where applicable) to open the **Flow Rate Calculator.** For more information about entering a flow rate based on a velocity using the **Flow Rate Calculator**, see: Flow Rate Calculator / Helper.
The **Pressure Loss** (for Find Flow, Find Diameter and Find Length) in the pipe can be specified by entering the value into the **Pressure Loss** field.

Tap the **Calculate** button to solve the calculation using the data supplied.

The **Results Panel** will slide up and over the calculation panel to display the results of the calculation. For more information about the Results Panel, see: Results Panel.

Depending upon the amount of information in the calculation panel and/or the height of the program window, it may be necessary to scroll down to reveal further information.

2.4 Results Panel

When a calculation is solved, the **Results Panel** slides up and over the **Calculation Panel**.

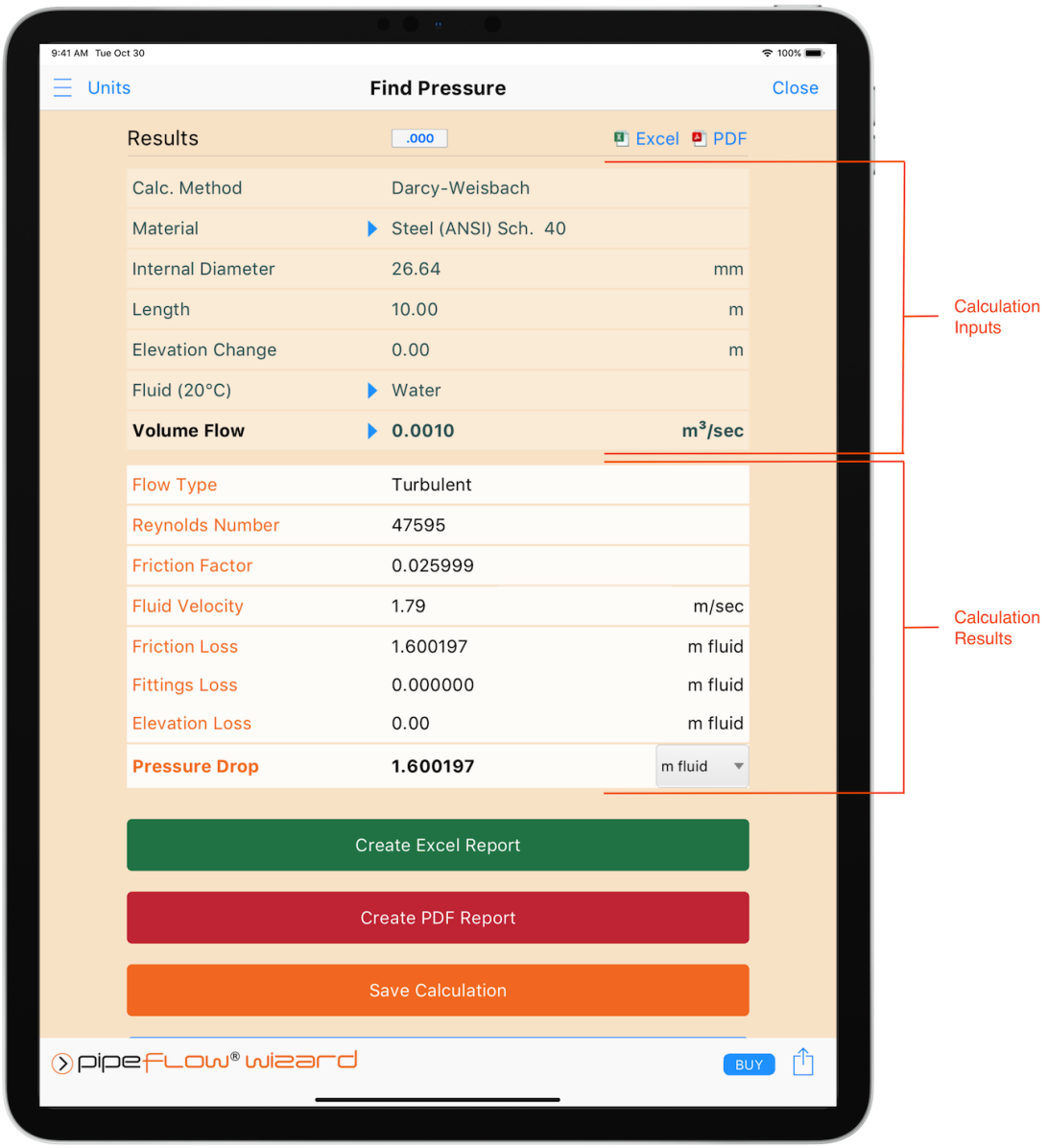


Figure 9 Results Panel

The results panel displays the data that was entered by the user at the top in the **Inputs** section and displays the results beneath the inputs in the **Results** section.

The display unit for each different item of data can be changed in Settings. In addition, for the main result (e.g. **Pressure Drop** for **Find Pressure**), the display unit can be changed by selecting the unit from the drop-down list. When the result panel is closed, and another calculation is performed, the result unit will be reset to the unit that is specified in settings for that attribute. For more information about setting units, see: Units.

Tapping the expander  button for a result attribute will reveal further data associated with that attribute. For further information about expanders, see: Expandable Sections.

2.4.1 Results Menu Bar

In the header of each result panel is the results menu bar.

Figure 10 Results Menu Bar

The menu bar contains three buttons which provides quick access to:

Menu Items	Description
.000	Setting the decimals for the results. For more information about results decimals, see: Results Decimals.
	Creating and viewing an Excel Report. For more information about Excel Reports, see: Creating a Report of the Results.
	Creating and viewing a PDF Report. For more information about PDF Reports, see: Creating a Report of the Results.

Depending upon the amount of information in the result panel and/or the height of the program window, it may be necessary to scroll down to reveal further information.

2.5 Results Share Action Sheet

In the footer of each result panel is the status bar. Tap the **Share** button to open the **Share Action Sheet.**

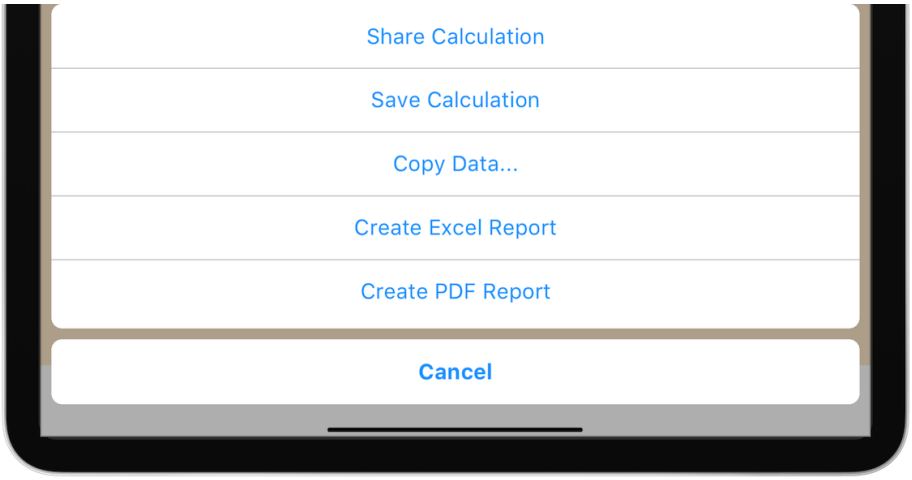


Figure 11 Results Share Action Sheet

Menu Items	Description
Share Calculation	Opens the iOS Share Action Sheet to allow the calculation to be exported from the device (e.g. via AirDrop, mail, DropBox etc.). For more information about sharing calculations, see: Sharing a Calculation.
Save Calculation	Saving the calculation to the local storage on the device. For more information, see Saved Files.
Copy Data…	Open the Results Share – Copy Calculation Action Sheet to copy the calculation data to one or more calculations. For more information about copying calculations, see: Copying Calculation Results for use in another Calculation.
Create Excel Report	Create and view an Excel Report. For more information about Excel Reports, see: Creating a Report of the Results.
Create PDF Report	Create and view a PDF Report. For more information about PDF Reports, see: Creating a Report of the Results.
Cancel	Close the **Share** action sheet.

2.6 Results Share – Copy Calculation Action Sheet

In the footer of each result panel is the status bar. Tap the **Share** button to open the **Share Action Sheet** and then tap **Copy Data….**

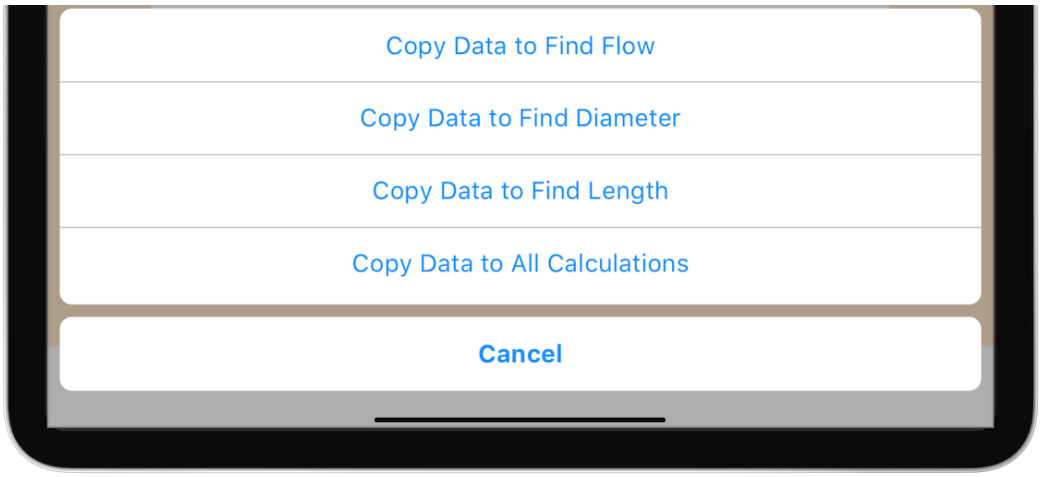


Figure 12 Results Share - Copy Calculation Action Sheet

Menu Items	Description
Copy Data to Find Flow	Copy the data of the active calculation to the **Find Flow** calculation. For more information about copying calculations, see: Copying Calculation Results for use in another Calculation.
Copy Data to Find Diameter	Copy the data of the active calculation to the **Find Diameter** calculation. For more information about copying calculations, see: Copying Calculation Results for use in another Calculation.
Copy Data to Find Length	Copy the data of the active calculation to the **Find Length** calculation. For more information about copying calculations, see: Copying Calculation Results for use in another Calculation.
Copy Data to All Calculations	Copy the data of the active calculation to the **All other** calculation. For more information about copying calculations, see: Copying Calculation Results for use in another Calculation.
Cancel	Close the **Copy Calculation a**ction sheet.

The Copy Calculation action sheet is context sensitive and therefore will not include the active calculation in the menu.

2.7 Expandable Sections

Pipe Flow Wizard uses expandable sections to allow the user to increase or reduce the information that is displayed.

Sections that can be expanded display the expander button which when tapped will expand the section to reveal more information.

Tapping the expander button when the section is expanded will collapse the section.

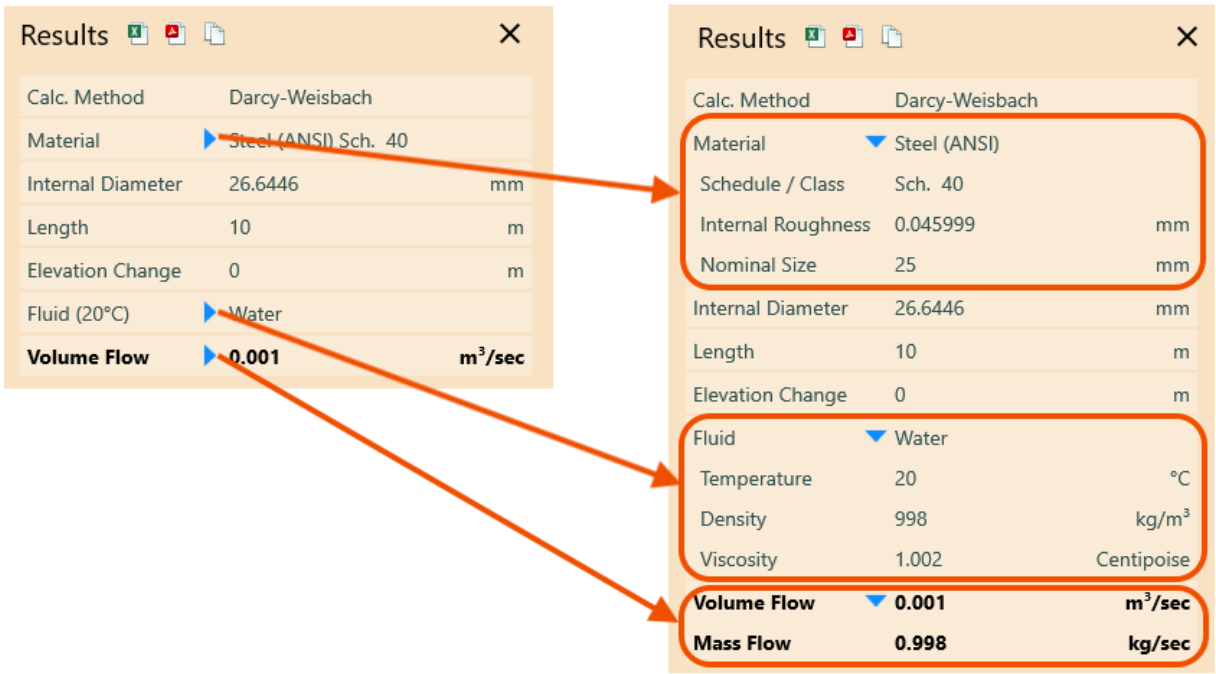


Figure 13 Expandable Sections

2.8 Notifications & Action Sheets

Messages that do not require user acknowledgement / interaction are displayed as a notification at the top of the screen.

These notifications are displayed for a short period of time.

To close a notification, tap or swipe up on the notification banner.

To prevent a notification from closing, press and hold on the notification banner.

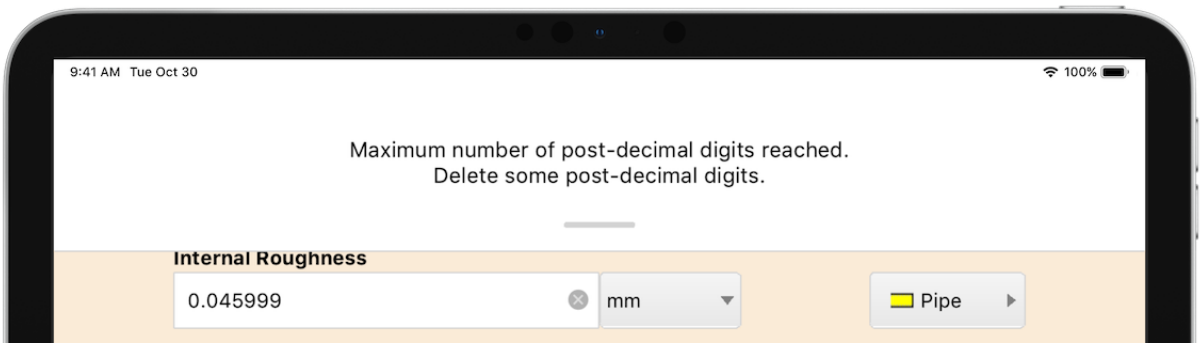


Figure 14 Temporary Notification

Some notifications may also display a button in the bottom right corner (e.g. More Details, or Learn More), which when tapped will open an information panel providing additional information about the notification.

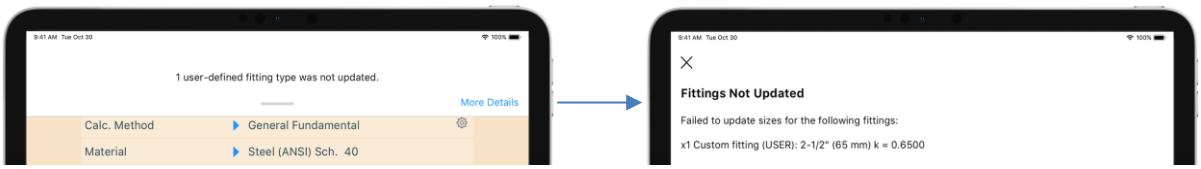


Figure 15 Temporary Notification with Additional Information

Action Sheets display at the bottom of the screen and allow the user to select certain options.

In some cases, action sheets are displayed in conjunction with a notification. When notifications appear with action sheets, the notification will remain on display and will be removed when an option on the action sheet has been selected – the notification cannot be removed by tapping or swiping.

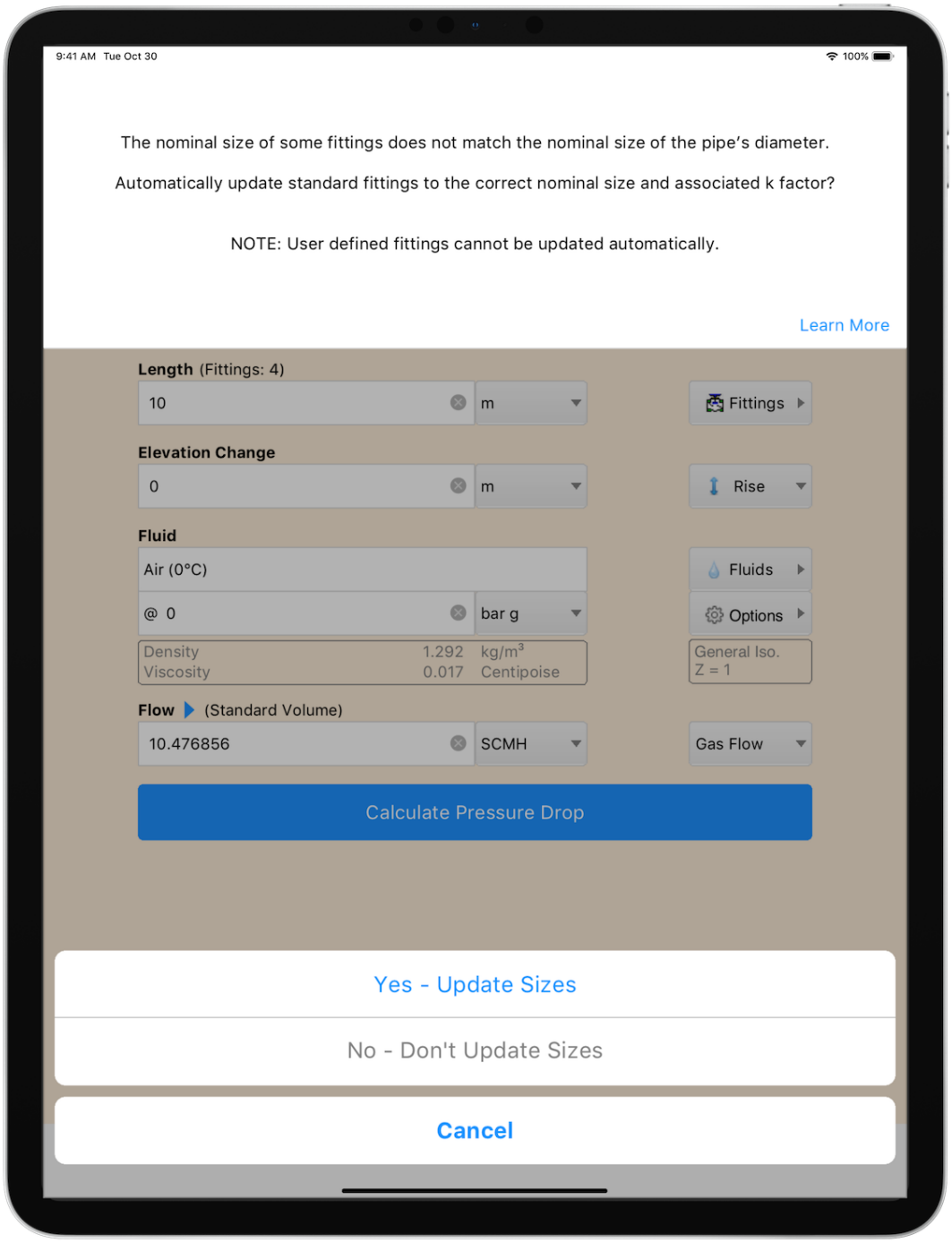


Figure 16 Notification with Action Sheet

3 Settings

Pipe Flow Wizard can be configured and set-up to suit the user's working preferences.

The settings screen is opened by tapping the **Main Menu** button and then **Settings.**

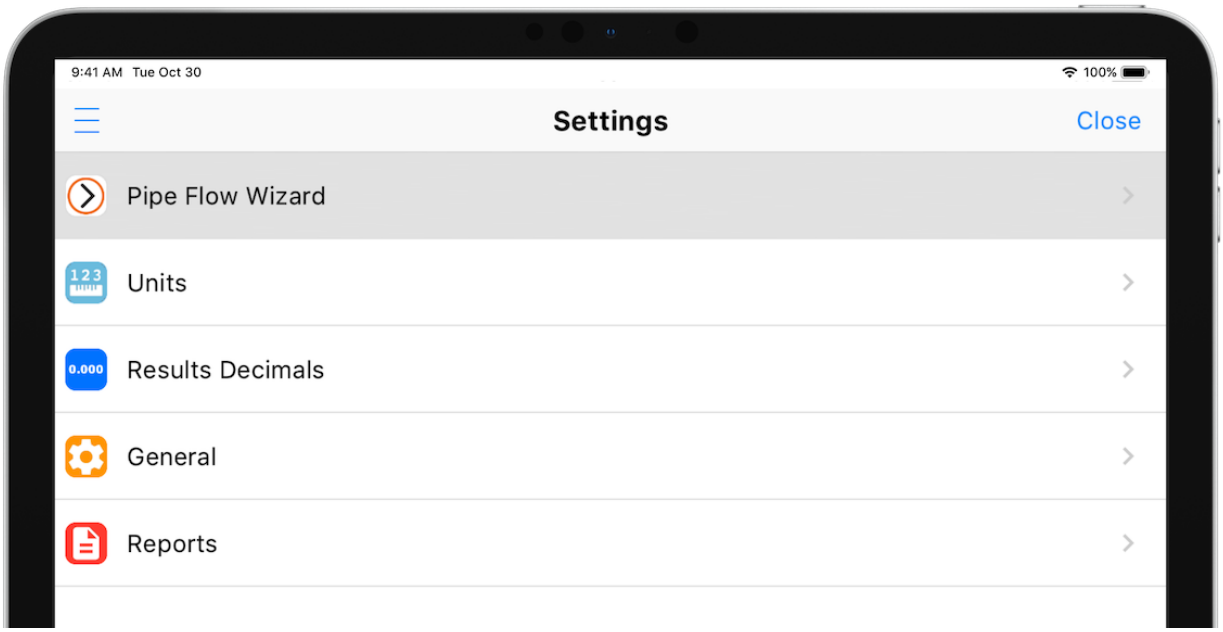


Figure 17 Settings

Menu Items	Description
Pipe Flow Wizard	Open the **Pipe Flow Wizard** screen. For more information, see: Pipe Flow Wizard.
Units	Open the **Units** screen. For more information, see: Units.
Results Decimals	Open the **Results Decimals** screen. For more information, see: Results Decimals.
General	Open the **General** menu. For more information, see: General.
Reports	Open the **Reports** screen. For more information, see: Reports.

3.1 Pipe Flow Wizard

The **Pipe Flow Wizard** screen is displayed by tapping the **Main Menu** button, **Settings** and then the **Pipe Flow Wizard** menu item**.**

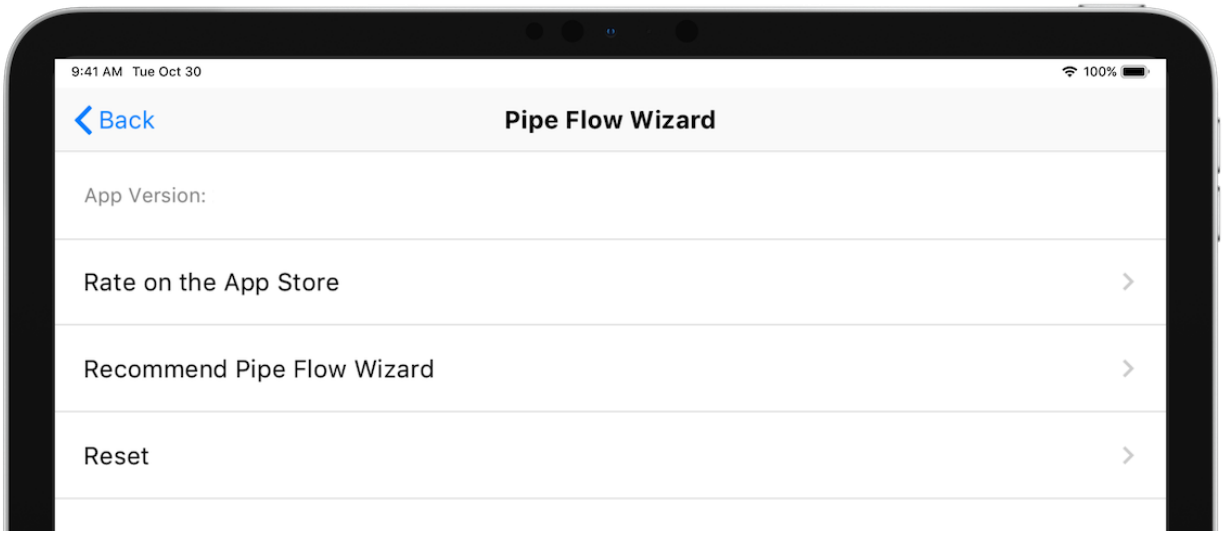


Figure 18 Pipe Flow Wizard Menu

Menu Items	Description
App Version	Displays the Pipe Flow Wizard version number.
Rate on the App Store	Open the Apple App Store so that you can provide a rating / review of Pipe Flow Wizard. For more information, see: Rate on the App Store.
Recommend Pipe Flow Wizard	Easily send a Pipe Flow Wizard recommendation e-mail to a friend or colleague. For more information, see: Recommend Pipe Flow Wizard.
Reset	Open the **Reset** screen. For more information, see: Reset.

3.1.1 Rate on the App Store

To provide a rating and/or review of Pipe Flow Wizard on the Apple App Store, tap the **Main Menu** button, **Settings** > **Pipe Flow Wizard** and then the **Rate on the App Store** menu item**.**

The App Store application on your device will be launched and the Pipe Flow Wizard App display from where you can leave a review / rating.

3.1.2 Recommend Pipe Flow Wizard

To easily recommend Pipe Flow Wizard to a friend or colleague, tap the **Main Menu** button, **Settings** > **Pipe Flow Wizard** and then the **Recommend Pipe Flow Wizard** menu item**.**

The Mail application on your device will be launched and new Email prepared containing some default text and a link to download the Pipe Flow Wizard.

Enter the email addresses of the people you wish to send the recommendation to and edit the body text as needed, then tap Send.

3.1.3 Reset

The **Reset** screen is displayed by tapping the **Main Menu** button, **Settings** > **Pipe Flow Wizard** and then the **Reset** menu item.

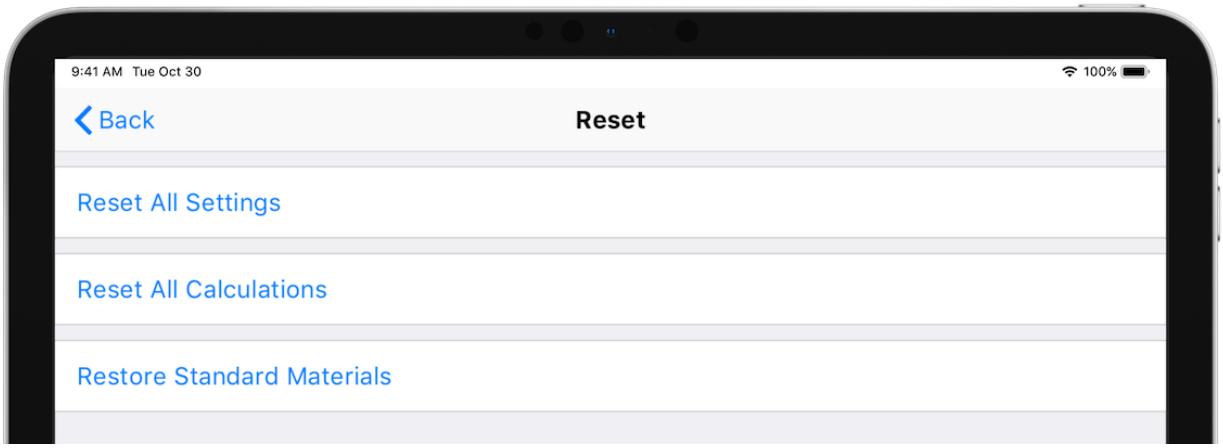


Figure 19 Reset

Option	Description
Reset All Settings	Reset all settings values to defaults.
Reset All Calculations	Reset all calculation values to defaults.
Restore Standard Material	Restore standard materials that have been deleted.

3.2 Units

The **Units** screen is displayed by tapping the **Main Menu** button, **Settings** and then **Units** menu item**.**

It can also be displayed by tapping the **Units** button in the **Navigation Bar** from any calculation.

Figure 20 Units

Units for each of the calculations can be specified by:

1. Selecting the required calculation from the ‘Calculation’ drop down.
2. Selecting the required unit for each of the attributes, OR
   Selecting Imperial / Metric to change all units for that calculation.
3. Tap Done.

Scroll down to reveal more units if not all units are displayed.

3.3 Results Decimals

The **Results Decimals** screen is displayed by tapping the **Main Menu** button, **Settings** and then **Results Decimals** menu item.

It can also be displayed by tapping on the .000 **Results Decimals** button in the **Results Menu Bar** form any calculation. For more information, see: Results Menu Bar.

The number of post decimal digits for each attribute can be specified individually, or all attributes can be set to the same number of post decimals by selecting a value from the **Set All Decimals** drop down.

The number of post decimal digits can be reset to their default values by tapping **Reset to Defaults**.

All results data displayed on the Results Panel and in the Excel / PDF reports will be displayed to the number of post decimals specified.

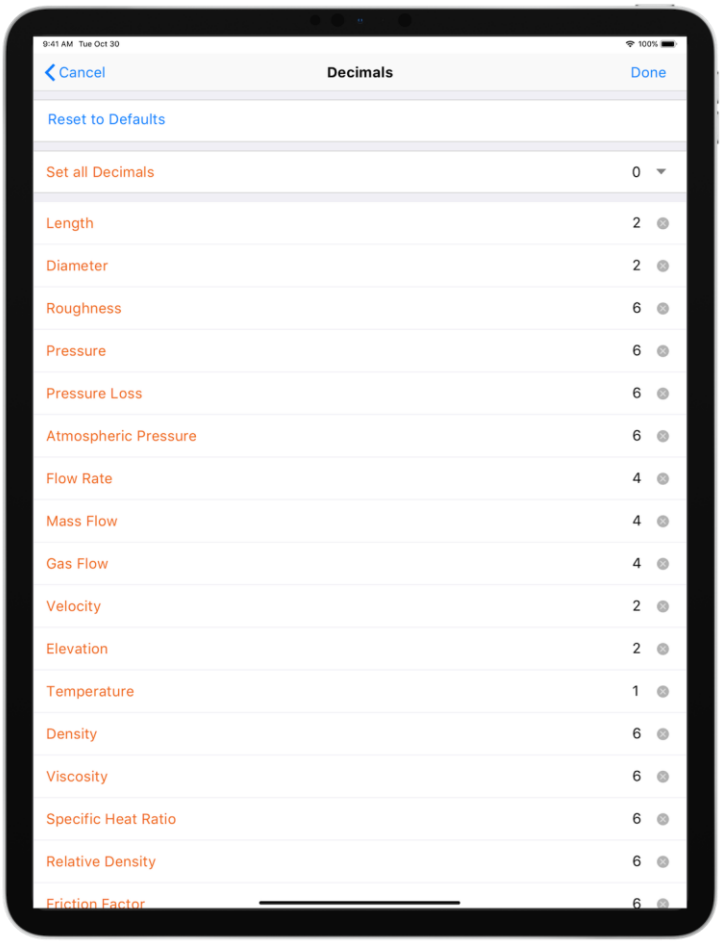


Figure 21 Results Decimals

Scroll down to reveal more attributes.

3.4 General

The **General** screen is displayed by tapping the **Main Menu** button, **Settings** and then **General** menu item.

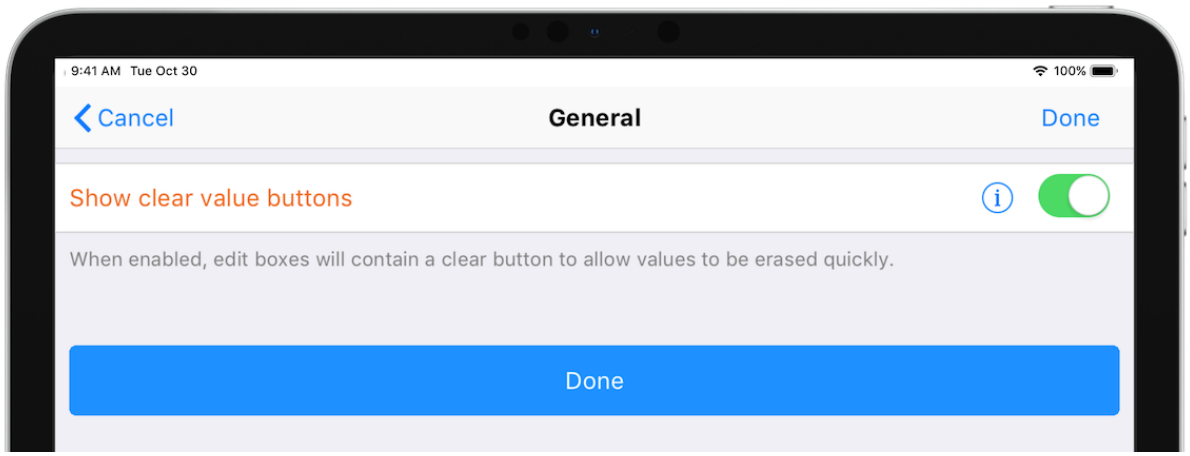


Figure 22 Settings General

Option	Description
Show clear value buttons	When checked, edit boxes contain a clear value button that when tapped will erase the contents of the edit box.

3.5 Reports

The **Reports** screen is displayed by tapping the **Main Menu** button, **Settings** and then **Reports** menu item.

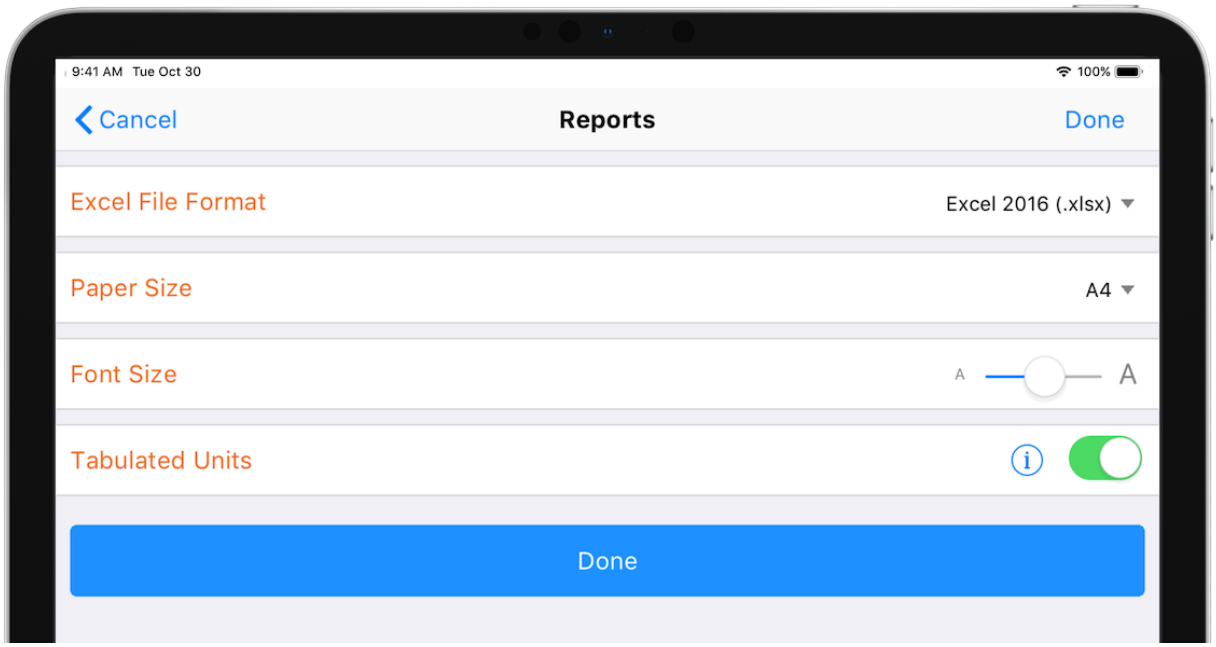


Figure 23 Settings Reports

Option	Description
Excel File Format	Configure the version of Excel that will be used.
Font Size	Configure the font size to use for the report.
Paper Size	Configure the paper size to use for the report.
Tabulated Units	When enabled, units will be displayed in their own column. When un-checked, units will be displayed next to their value in the same column. For examples of tabulated and non-tabulated reports, see: PDF Report Example – Tabulated Units and PDF Report Example – Non-Tabulated Units

4 File and Calculation Operations

4.1 Filename Extensions

The filename extensions for each calculation are as follows:

Calculation	File Extension
Find Pressure	pfwp
Find Flow	pfwf
Find Diameter	pfwd
Find Length	pfwl

4.2 Saving a Calculation

When on the results panel of a calculation, tap **Save Calculation** to display the filename dialog. It is not necessary to add a file extension. The filename will be pre-

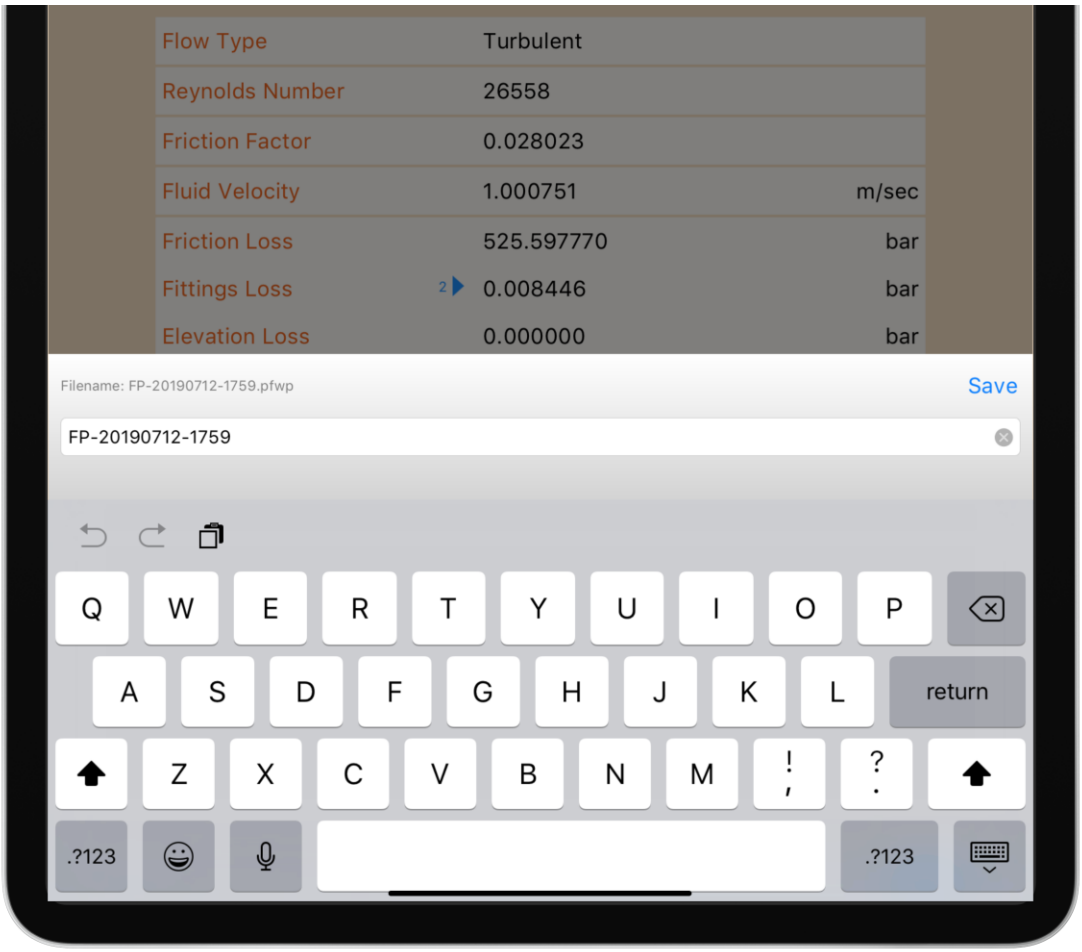


Figure 24 Save Dialog

populated with a default filename, alternatively this can be cleared / overtyped with your own filename.

Saved calculations are stored on your device and can be accessed by tapping **Saved Files** on the **Main Menu.**

4.3 Saved Files

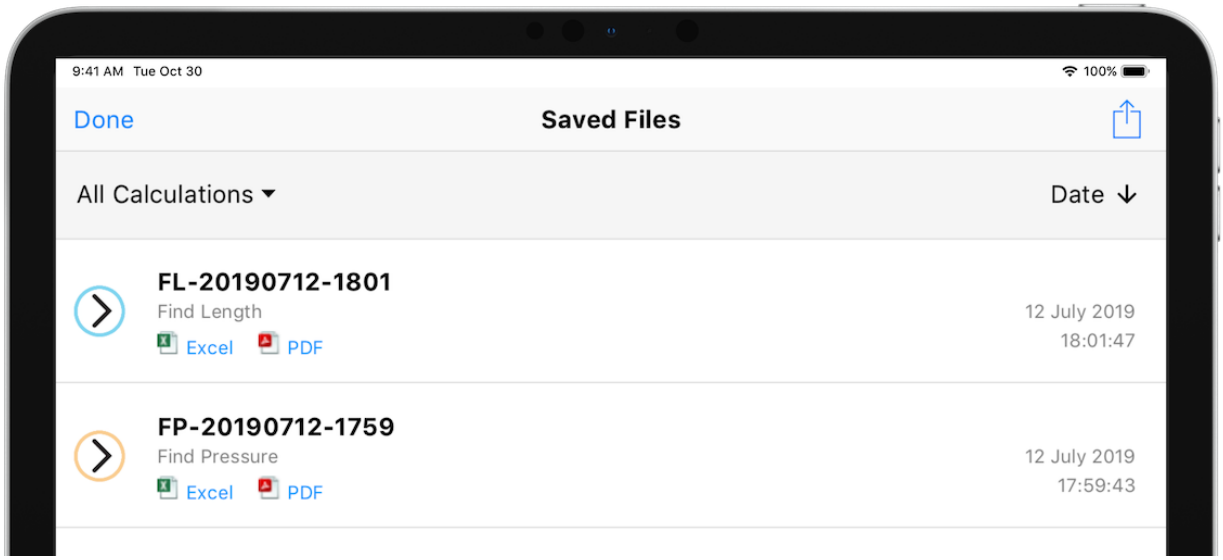


Figure 25 Saved Files - All Calculations

The **Saved Files** screen displays all calculations that have been saved to your device. The file list can be filtered to show only calculations of a specific type by selecting the required calculation in the calculation drop down (e.g. Find Length).

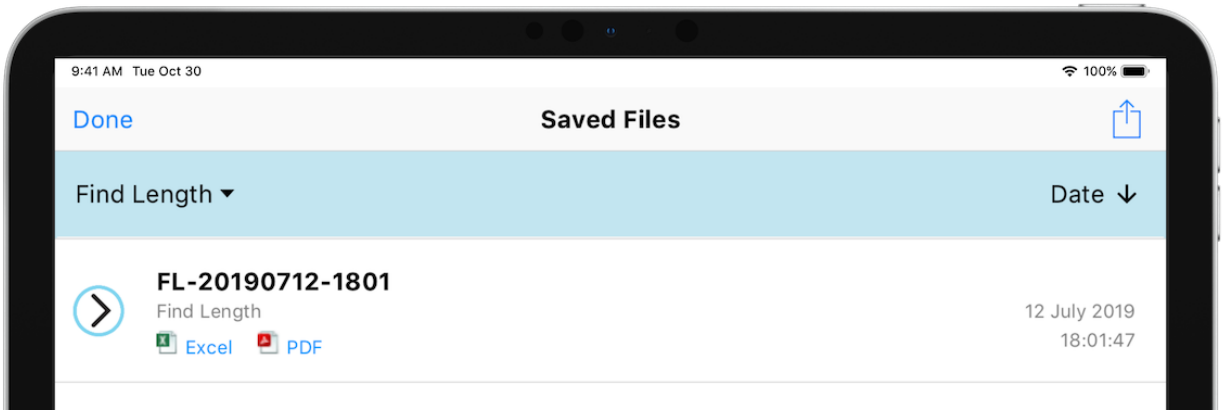


Figure 26 Saved Files - Find Length (specific calculation)

Tap on a row in the list to load the calculation.

Tap the **Excel** or **PDF** buttons to create and view a calculation report directly from the **Saved Files** screen.

Swipe right to left, on a row in the list, to display the additional action buttons for the saved file.

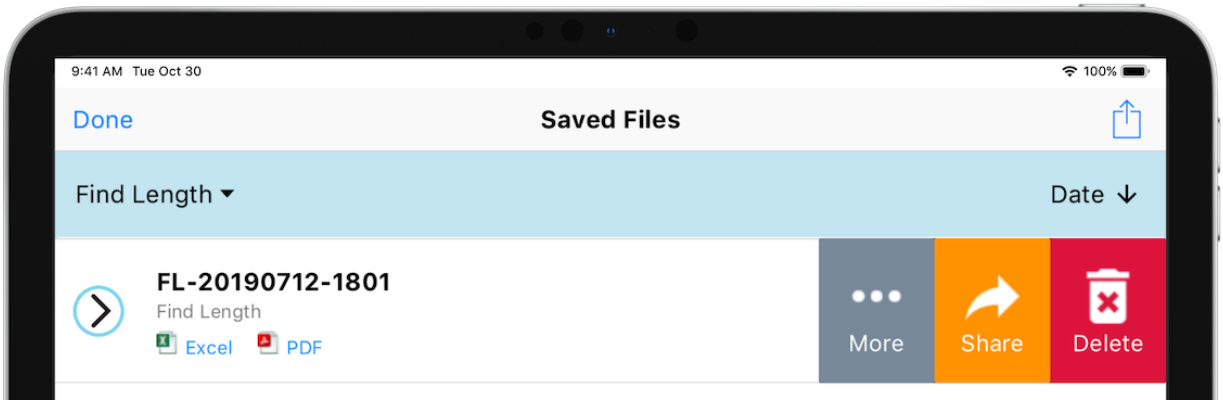


Figure 27 Saved Files (Action Buttons)

Action Button	Description
More	Displays the more action sheet with options to create an Excel or PDF report.
Share	Displays the **iOS Share Action Sheet** so that the calculation can be shared with other Pipe Flow Wizard users (on any device).
Delete	Delete the selected file from your device. A confirmation dialog will be displayed to confirm the file deletion. Once deleted, the file cannot be recovered.

4.3.1 Export / Backup all Files

To export / backup all calculation files on your device, tap the button to display the **Share Action** sheet and tap **Export all Calculations.** Pipe Flow Wizard will create a compressed folder (zip) containing all the calculation files and then display the **iOS Share Action** sheet from where you can select how to share the zip file. For example, you can select to send the zip file via e-mail or use a third-party cloud service such as Drop Box.

4.4 Sharing a Calculation

The calculation data can be shared with other Pipe Flow Wizard users (on any device).

To share a calculation, tap the **Share** button to display the associated action sheet. This will be either the Results Panel Share Action Sheet (depending upon the current panel shown) or the Calculation Panel Share Action Sheet.

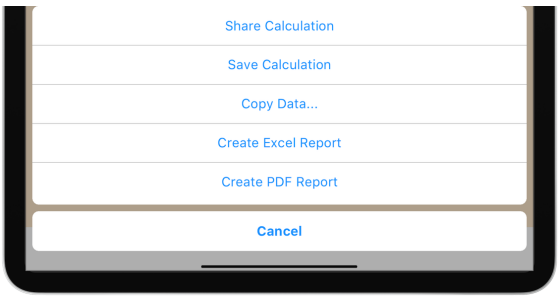


Figure 28 Results Panel Share Action Sheet

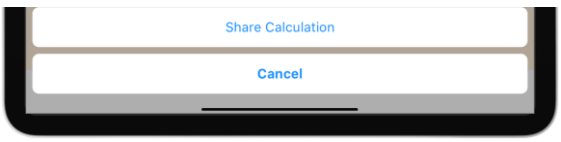


Figure 29 Calculation Panel Share Action Sheet

Tap **Share Calculation** to show the **iOS Share Action Sheet.**

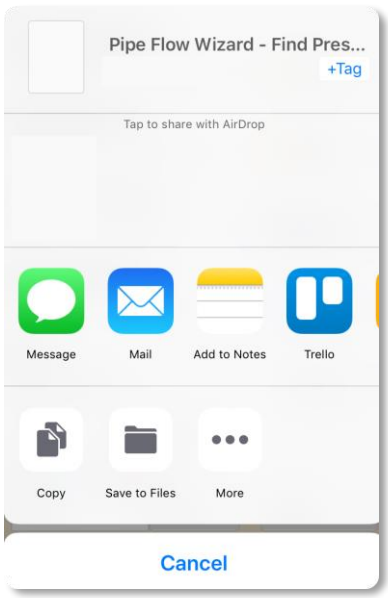


Figure 30 iOS Share Action Sheet

Tap the required method of sharing the calculation.

The options / applications available on the iOS Share Sheet will depend upon the applications installed on the device and how the share sheet is configured.

4.5 Loading a Calculation

Calculations that have been saved on your device, or that have been shared with you (e.g. via email) can be opened in Pipe Flow Wizard.

4.5.1 Load Calculation from Saved Files

The Saved Files screen is displayed by tapping the **Main Menu** button, then **Saved Files.** For more information, see Saved Files.

Tap the required calculation in the list to load it from your device.

4.5.2 Load Calculation from Shared File

A calculation that has been shared (e.g. via email) can be opened in Pipe Flow Wizard.

1. Open the e-mail that contains the Pipe Flow Wizard attachment. For more information on the type of files Pipe Flow Wizard uses see: Filename Extensions.

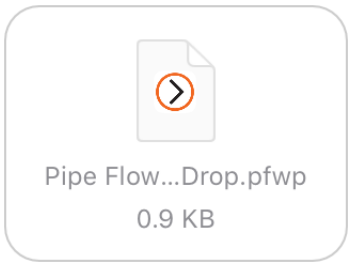


Figure 31 Pipe Flow Wizard Attachment

2. Tap the attachment to open the **iOS Share Sheet**.

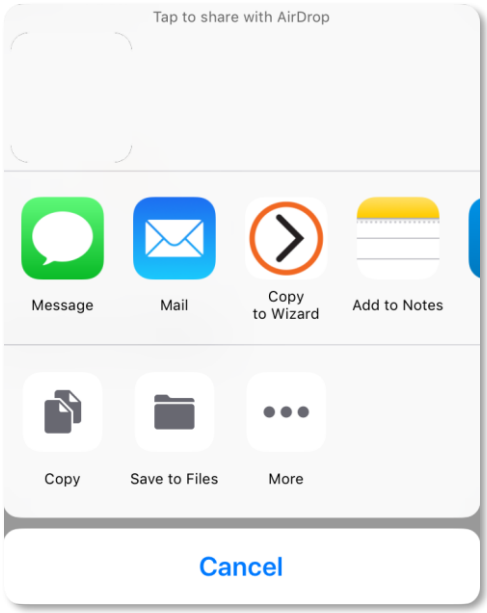


Figure 32 iOS Share Sheet

If the **Copy to Wizard** option is not immediately available, it may be necessary to swipe the applications to the left.

4.5.3 Display Filename of Loaded Calculation

When a calculation has been loaded from a file, the calculation title (e.g. Find Pressure) changes color from black to blue. Tapping the blue calculation title will display the name of the loaded file in a temporary notification.

Figure 33 Calculation Loaded Screen Title

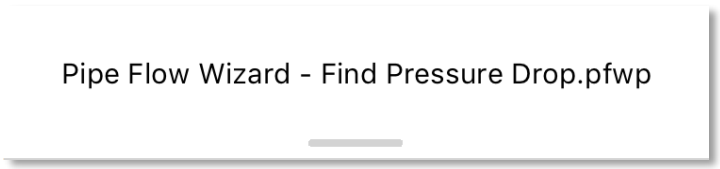


Figure 34 Filename of Loaded Notification

5 Pressure Drop Calculation

The **Pressure Drop** through the pipe can be calculated when the following values are known:

- Pipe internal roughness
- Pipe internal diameter
- Pipe length
- Pipe elevation change
- Fittings
- Flow rate

The **Pressure Drop** can be calculated for both Liquids and Gases. For information about selecting a fluid, see: Fluids Database.

For more information about working with gases, see: Working with Compressible Fluids.

For more information about the theory and formulas used to calculate the flow rate, see: Calculation Theory and Method of Solutions.

5.1 Pressure Drop Calculation - Liquid

The pressure drop for a liquid in a pipe can be calculated as follows:

1. Select the **Find Pressure** calculation.

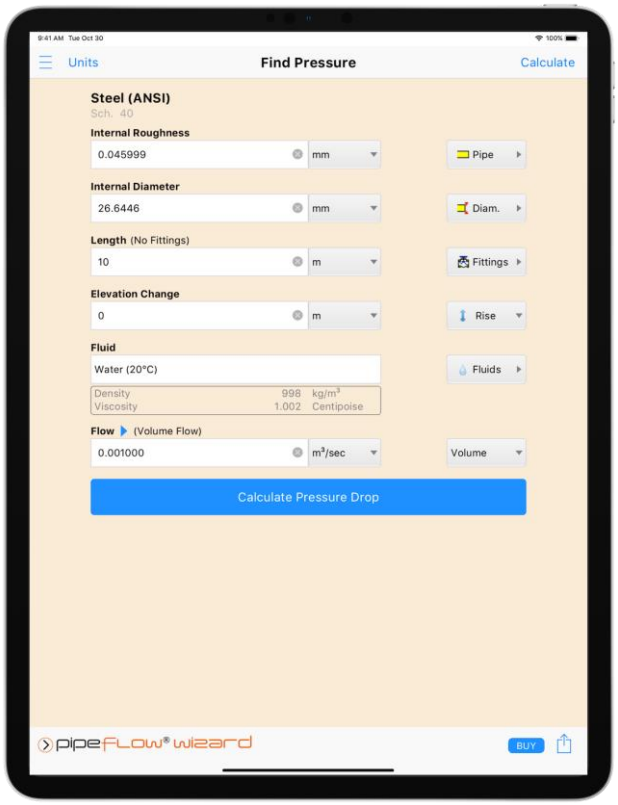


Figure 35 Find Pressure Calculation - Liquid

2. Select or define the **Material** and **Internal Roughness** of the pipe. For more information about working with pipe materials, see: Pipe Material & Diameters.
3. Select or define the **Internal Diameter** of the pipe. For more information about working with pipe diameters, see: Pipe Material & Diameters.
4. Set the **Length** and **Elevation Change** of the pipe.
5. Add **Fittings** to the pipe if required. For more information about working with fittings, see: Fittings & Valves.
6. Select the **Fluid** in the pipe. For more information about working with fluid, see: Fluids Database.
7. Enter the **Flow Rate** of the fluid in the pipe. For more information about setting a flow rate based on a velocity, see: Flow Rate Calculator / Helper.
8. Tap **Calculate Pressure Drop** and the **Results** panel will slide up.

The internal diameter will be reset to 1.049” (26.64 mm) if running the trial version of Pipe Flow Wizard.

The **Find Pressure Results Panel** displays the calculation input data and the results of the **Pressure Drop** calculation. For more information about the Results Panel, see: Results Panel.

The pressure loss unit can be changed as required. To change the pressure loss unit for all subsequent calculations, the pressure loss unit can be specified in Settings > Units. For more information about setting units, see: Units

To generate and view an Excel or PDF Report of the results, tap the Excel button or PDF button. For more information about generating reports, see: Creating a Report of the Results.

To change the number of decimals the results are displayed to, tap the .000 **Results Decimals** button in the **Results Menu Bar**. For more information, see: Results Menu Bar.

To copy the calculation data to one or more other calculations, tap the Copy button and select the required calculation(s).

To close the **Results Panel,** tap the **Close** button in the **Navigation Bar** or the **Close Results** Close Results button at the bottom.

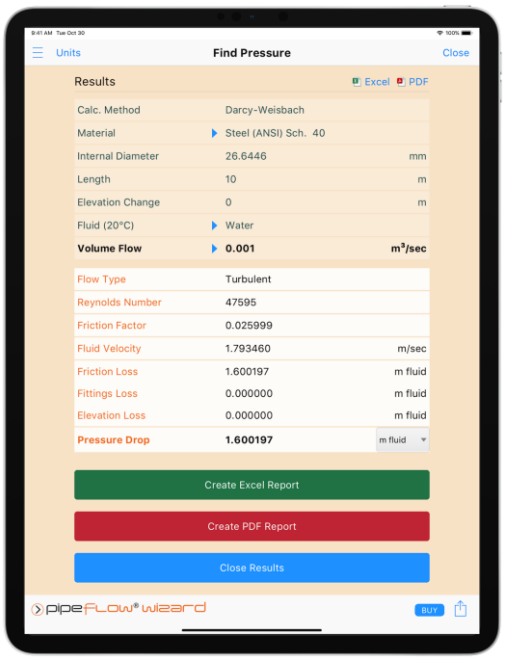


Figure 36 Find Pressure Results - Liquid

5.2 Pressure Drop Calculation - Gas

The pressure drop for a gas in a pipe can be calculated as follows:

1. Select the **Find Pressure** calculation.

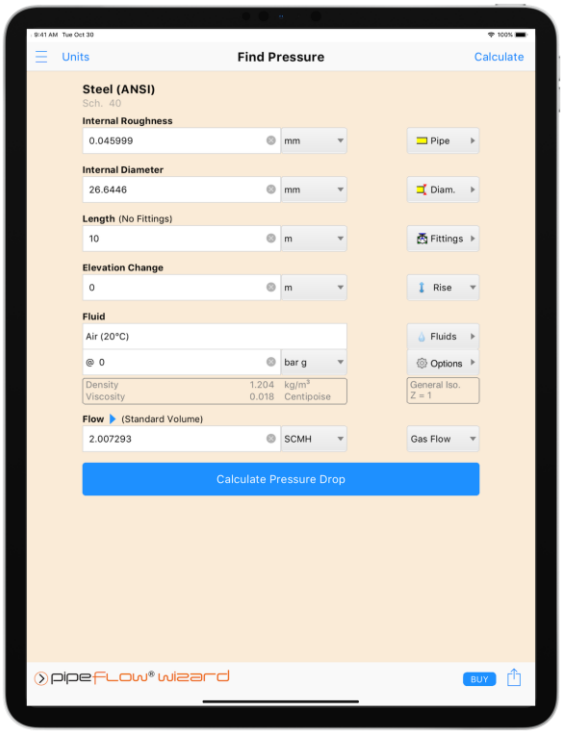


Figure 37 Find Pressure Calculation - Gas

2. Select or define the **Material** and **Internal Roughness** of the pipe. For more information about working with pipe materials, see: Pipe Material & Diameters.
3. Select or define the **Internal Diameter** of the pipe. For more information about working with pipe diameters, see: Pipe Material & Diameters.
4. Set the **Length** and **Elevation Change** of the pipe.
5. Add **Fittings** to the pipe if required. For more information about working with fittings, see: Fittings & Valves.
6. Select the **Fluid** in the pipe. For more information about working with fluid, see: Fluids Database.
7. Enter the **Pressure** of the fluid at the start of the pipe.
8. Enter the **Flow Rate** of the fluid in the pipe. For more information about setting a flow rate based on a velocity, see: Flow Rate Calculator / Helper.
9. Tap **Calculate Pressure Drop** and the **Results** panel will slide up.

The internal diameter will be reset to 1.049” (26.64 mm) if running the trial version of Pipe Flow Wizard.

The **Find Pressure Results Panel** displays the calculation input data and the results of the **Pressure Drop** calculation. For more information about the Results Panel, see: Results Panel.

The pressure loss unit can be changed as required. To change the pressure loss unit for all subsequent calculations, the pressure loss unit can be specified in Settings > Units. For more information about setting units, see: Units

To generate and view an Excel or PDF Report of the results, tap the Excel button or PDF button. For more information about generating reports, see: Creating a Report of the Results.

To change the number of decimals the results are displayed to, tap the .000 **Results Decimals** button in the **Results Menu Bar**. For more information, see: Results Menu Bar.

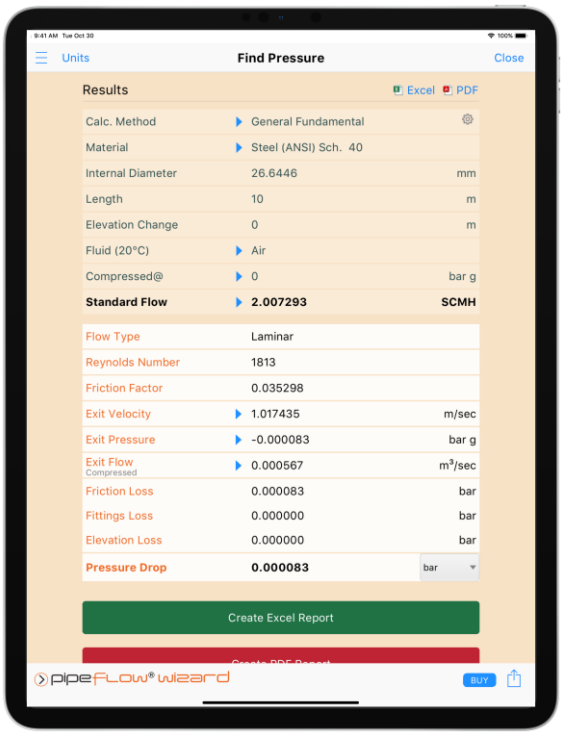


Figure 38 Find Pressure Results - Gas

To copy the calculation data to one or more other calculations, tap the Copy button and select the required calculation(s).

To close the **Results Panel,** tap the **Close** button in the **Navigation Bar** or the **Close Results** Close Results button at the bottom.

6 Flow Rate Calculation

The **Flow Rate** through the pipe can be calculated when the following values are known:

- Pipe internal roughness
- Pipe internal diameter
- Pipe length
- Pipe elevation change
- Fittings
- Pressure Loss

The **Flow Rate** can be calculated for both Liquids and Gases. For information about selecting a fluid, see: Fluids Database.

For more information about working with gases, see: Working with Compressible Fluids.

For more information about the theory and formulas used to calculate the flow rate, see: Calculation Theory and Method of Solutions.

6.1 Flow Rate Calculation - Liquid

The flow rate for a liquid in a pipe can be calculated as follows:

1. Select the **Find Flow** calculation.

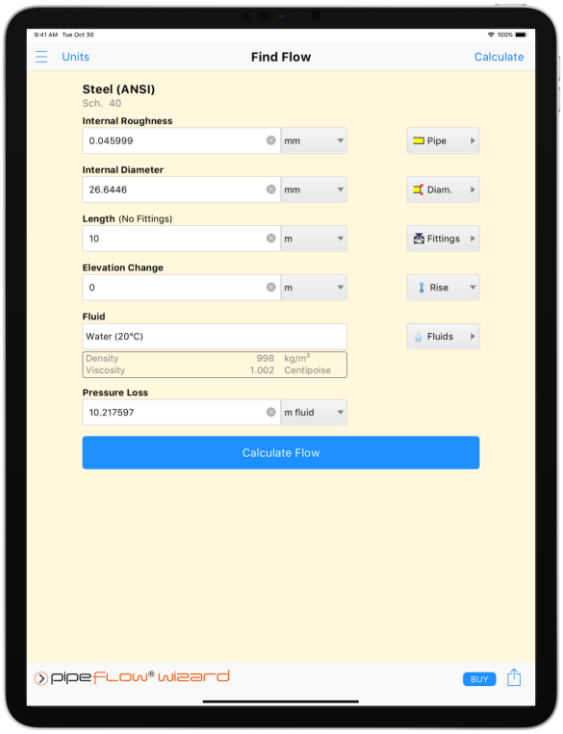


Figure 39 Find Flow Calculation - Liquid

2. Select or define the **Material** and **Internal Roughness** of the pipe. For more information about working with pipe materials, see: Pipe Material & Diameters.
3. Select or define the **Internal Diameter** of the pipe. For more information about working with pipe diameters, see: Pipe Material & Diameters.
4. Set the **Length** and **Elevation Change** of the pipe.
5. Add **Fittings** to the pipe if required. For more information about working with fittings, see: Fittings & Valves.
6. Select the **Fluid** in the pipe. For more information about working with fluid, see: Fluids Database.
7. Enter the **Pressure Loss**.
8. Tap **Calculate Flow,** the **Results Panel** will slide up.

The internal diameter will be reset to 1.049” (26.64 mm) if running the trial version of Pipe Flow Wizard.

The **Find Flow Results Panel** displays the calculation input data and the results of the **Find Flow** calculation. For more information about the Results Panel, see: Results Panel.

The **Flow** units can be changed as required. To change the flow units for all subsequent calculations, the flow unit can be specified in Settings > Units. For more information about setting units, see Units.

To generate and view an Excel or PDF Report of the results, tap the Excel button or PDF button. For more information about generating reports, see: Creating a Report of the Results.

To change the number of decimals the results are displayed to, tap the .000 **Results Decimals** button in the **Results Menu Bar**. For more information, see: Results Menu Bar.

To copy the calculation data to one or more other calculations, tap the Copy button and select the required calculation(s).

To close the **Results Panel,** tap the **Close** button in the **Navigation Bar** or the **Close Results** Close Results button at the bottom.

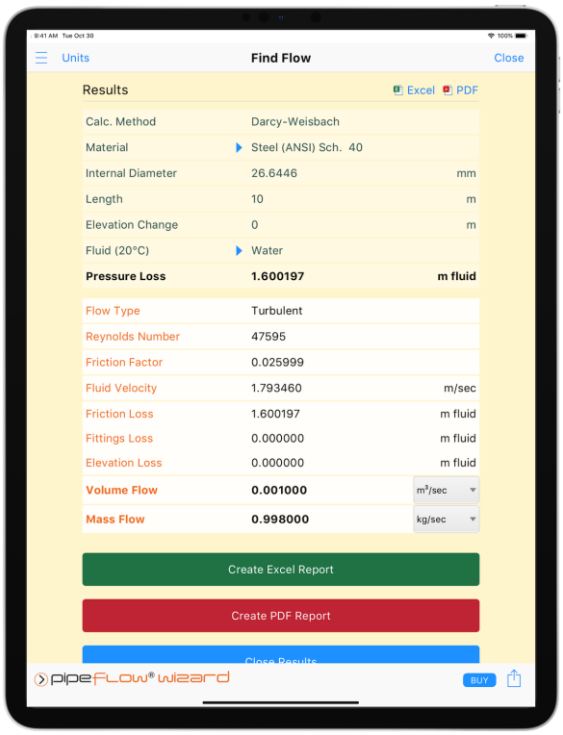


Figure 40 Find Flow Results - Liquid

6.2 Flow Rate Calculation - Gas

The flow rate for a gas in a pipe can be calculated as follows:

1. Select the **Find Flow** calculation.

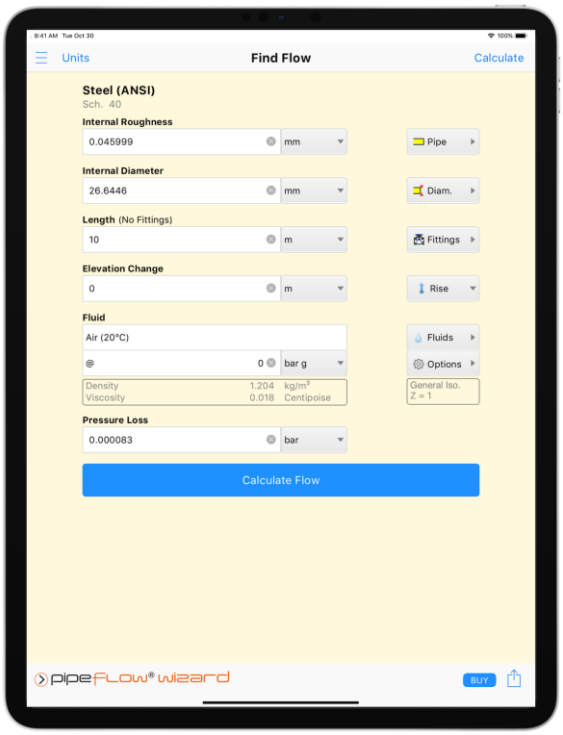


Figure 41 Find Flow Calculation - Gas

2. Select or define the **Material** and **Internal Roughness** of the pipe. For more information about working with pipe materials, see: Pipe Material & Diameters.
3. Select or define the **Internal Diameter** of the pipe. For more information about working with pipe diameters, see: Pipe Material & Diameters.
4. Set the **Length** and **Elevation Change** of the pipe.
5. Add **Fittings** to the pipe if required. For more information about working with fittings, see: Fittings & Valves.
6. Select the **Fluid** in the pipe. For more information about working with fluid, see: Fluids Database.
7. Enter the **Pressure** of the fluid at the start of the pipe.
8. Enter the **Pressure Loss**.
9. Tap **Calculate Flow,** the **Results Panel** will slide up.

The internal diameter will be reset to 1.049” (26.64 mm) if running the trial version of Pipe Flow Wizard.

The **Find Flow Results Panel** displays the calculation input data and the results of the **Find Flow** calculation. For more information about the Results Panel, see: Results Panel.

The **Flow** units can be changed as required. To change the flow units for all subsequent calculations, the flow unit can be specified in Settings > Units. For more information about setting units, see Units.

To generate and view an Excel or PDF Report of the results, tap the Excel button or PDF button. For more information about generating reports, see: Creating a Report of the Results.

To change the number of decimals the results are displayed to, tap the .000 **Results Decimals** button in the **Results Menu Bar**. For more information, see: Results Menu Bar.

To copy the calculation data to one or more other calculations, tap the Copy button and select the required calculation(s).

To close the **Results Panel,** tap the **Close** button in the **Navigation Bar** or the **Close Results** Close Results button at the bottom.

Figure 42 Find Flow Results - Gas

7 Pipe Diameter Calculation

The **Maximum Internal Diameter** of the pipe can be calculated when the following values are known:

- Pipe internal roughness
- Pipe length
- Pipe elevation change
- Fittings
- Required flow rate
- Maximum allowed pressure drop

The **Pipe Diameter** can be calculated for both Liquids and Gases. For information about selecting a fluid, see: Fluids Database.

For more information about working with gases, see: Working with Compressible Fluids.

For more information about the theory and formulas used to calculate the flow rate, see: Calculation Theory and Method of Solutions.

7.1 Pipe Diameter Calculation - Liquid

The minimum internal diameter of a pipe for a required liquid flow rate and maximum allowable pressure loss can be calculated as follows:

1. Select the **Find Diameter** calculation.

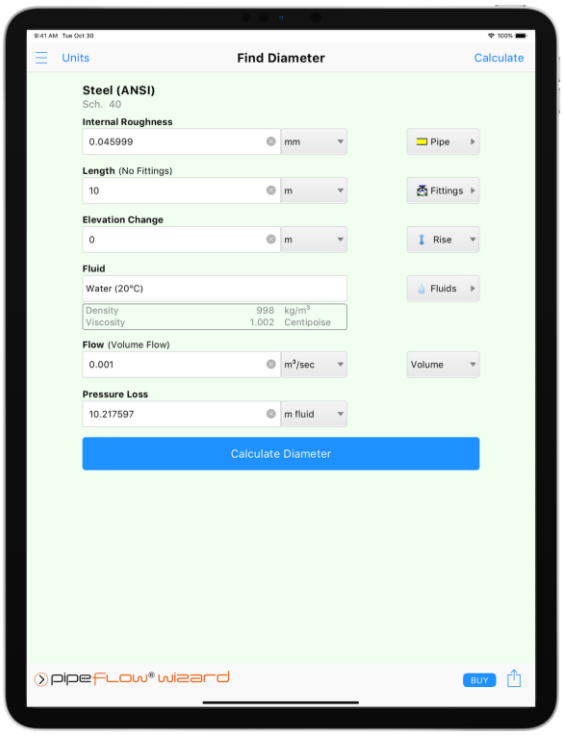


Figure 43 Find Diameter Calculation - Liquid

2. Select or define the **Material** and **Internal Roughness** of the pipe. For more information about working with pipe materials, see: Pipe Material & Diameters.
3. Set the **Length** and **Elevation Change** of the pipe.
4. Add **Fittings** to the pipe if required. For more information about working with fittings, see: Fittings & Valves.
5. Select the **Fluid** in the pipe. For more information about working with fluid, see: Fluids Database.
6. Enter the **Flow Rate** of the fluid in the pipe. For more information about setting a flow rate, see: Flow Rate Calculator / Helper.
7. Enter the maximum **Pressure Loss** of in the pipe.
8. Tap **Calculate Diameter** and the **Results** panel will slide up.

The length will be reset to 32.80 ft (10 m) if running the trial version of Pipe Flow Wizard.

The **Find Diameter Results Panel** displays the calculation input data and the results of the **Find Diameter** calculation. For more information about the Results Panel, see: Results Panel.

The **Diameter** units can be changed as required. To change the diameter units for all subsequent calculations, the diameter unit can be specified in Settings > Units. For more information about setting units, see: Units.

To generate and view an Excel or PDF Report of the results, tap the Excel button or PDF button. For more information about generating reports, see: Creating a Report of the Results.

To change the number of decimals the results are displayed to, tap the .000 **Results Decimals** button in the **Results Menu Bar**. For more information, see: Results Menu Bar.

To copy the calculation data to one or more other calculations, tap the Copy button and select the required calculation(s).

To close the **Results Panel,** tap the **Close** button in the **Navigation Bar** or the **Close Results** Close Results button at the bottom.

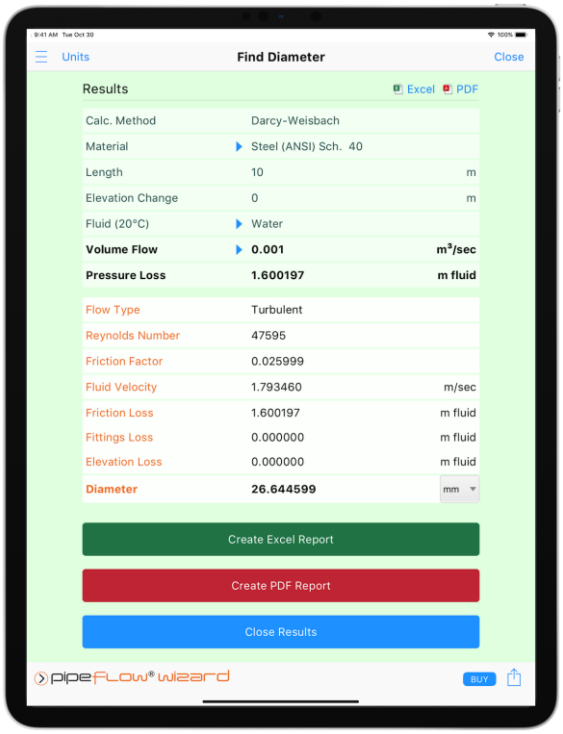


Figure 44 Find Diameter Results - Liquid

7.2 Pipe Diameter Calculation - Gas

The minimum internal diameter of a pipe for a required gas flow rate and maximum allowable pressure loss can be calculated as follows:

1. Select the **Find Diameter** calculation.

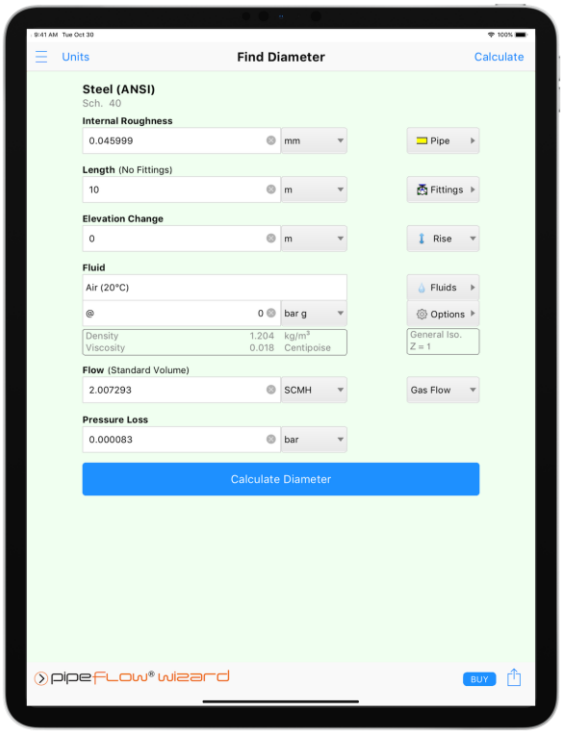


Figure 45 Find Diameter Calculation - Gas

2. Select or define the **Material** and **Internal Roughness** of the pipe. For more information about working with pipe materials, see: Pipe Material & Diameters.
3. Set the **Length** and **Elevation Change** of the pipe.
4. Add **Fittings** to the pipe if required. For more information about working with fittings, see: Fittings & Valves.
5. Select the **Fluid** in the pipe. For more information about working with fluid, see: Fluids Database.
6. Enter the **Pressure** of the fluid at the start of the pipe.
7. Enter the **Flow Rate** of the fluid in the pipe. For more information about setting a flow rate, see: Flow Rate Calculator / Helper.
8. Enter the maximum **Pressure Loss** in the pipe.
9. Tap **Calculate Diameter** and the **Results** panel will slide up.

The length will be reset to 32.80 ft (10 m) if running the trial version of Pipe Flow Wizard.

The **Find Diameter Results Panel** displays the calculation input data and the results of the **Find Diameter** calculation. For more information about the Results Panel, see: Results Panel.

The **Diameter** units can be changed as required. To change the diameter units for all subsequent calculations, the diameter unit can be specified in Settings > Units. For more information about setting units, see: Units.

To generate and view an Excel or PDF Report of the results, tap the Excel button or PDF button. For more information about generating reports, see: Creating a Report of the Results.

To change the number of decimals the results are displayed to, tap the .000 **Results Decimals** button in the **Results Menu Bar**. For more information, see: Results Menu Bar.

To copy the calculation data to one or more other calculations, tap the Copy button and select the required calculation(s).

To close the **Results Panel,** tap the **Close** button in the **Navigation Bar** or the **Close Results** Close Results button at the bottom.

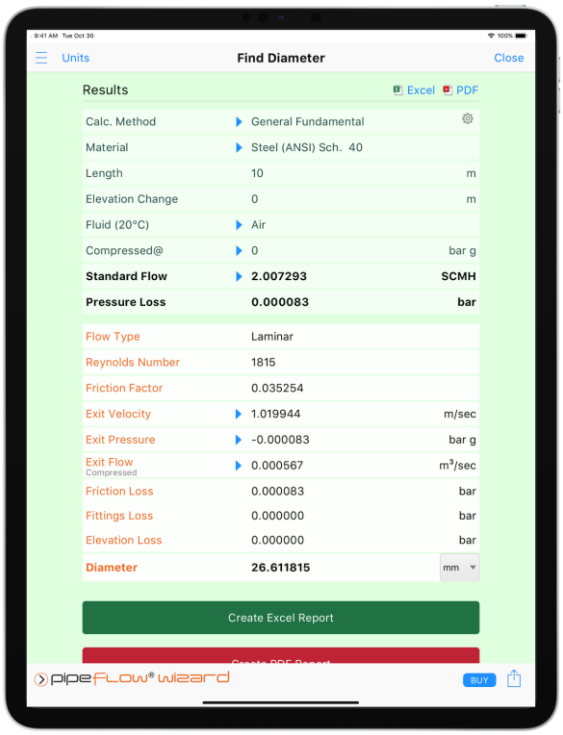


Figure 46 Find Diameter Results - Gas

8 Pipe Length Calculation

The pipe **Length** can be calculated when the following values are known:

- Pipe internal roughness
- Pipe internal diameter
- Pipe elevation change
- Required flow rate
- Maximum allowed pressure drop

The **Pipe Length** can be calculated for both Liquids and Gases. For information about selecting a fluid, see: Fluids Database.

For more information about working with gases, see: Working with Compressible Fluids.

For more information about the theory and formulas used to calculate the flow rate, see: Calculation Theory and Method of Solutions.

8.1 Pipe Length Calculation - Liquid

The maximum length of a pipe which allows a required liquid flow rate for a maximum allowable pressure loss can be calculated as follows:

1. Select the **Find Length** calculation.

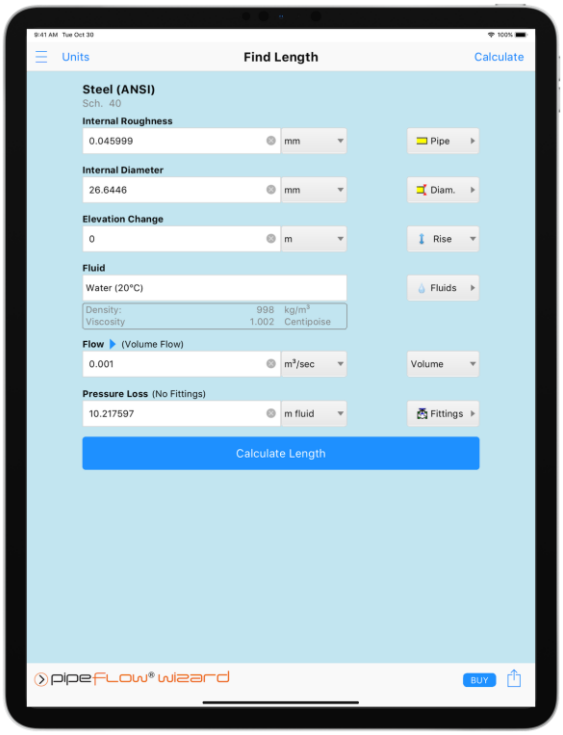


Figure 47 Find Length Calculation - Liquid

2. Select or define the **Material** and **Internal Roughness** of the pipe. For more information about working with pipe materials, see: Pipe Material & Diameters.
3. Select or define the **Internal Diameter** of the pipe. For more information about working with pipe diameters, see: Pipe Material & Diameters.
4. Set the **Elevation Change** of the pipe.
5. Select the **Fluid** in the pipe. For more information about working with fluid, see: Fluids Database.
6. Enter the **Flow Rate** of the fluid in the pipe. For more information about setting a flow rate, see: Flow Rate Calculator / Helper.
7. Enter the **Pressure Loss** in the pipe.
8. Add **Fittings** to the pipe if required. For more information about working with fittings, see: Fittings & Valves.
9. Tap **Calculate Length** and the **Results** panel will slide up.

The internal diameter will be reset to 1.049” (26.64 mm) if running the trial version of Pipe Flow Wizard.

The **Find Length Results Panel** displays the calculation input data and the results of the **Find Length** calculation. For more information about the Results Panel, see: Results Panel.

The **Length** units can be changed as required. To change the length units for all subsequent calculations, the length unit can be specified in Settings > Units. For more information about setting units, see: Units.

To generate and view an Excel or PDF Report of the results, tap the Excel button or PDF button. For more information about generating reports, see: Creating a Report of the Results.

To change the number of decimals the results are displayed to, tap the .000 **Results Decimals** button in the **Results Menu Bar**. For more information, see: Results Menu Bar.

To copy the calculation data to one or more other calculations, tap the Copy button and select the required calculation(s).

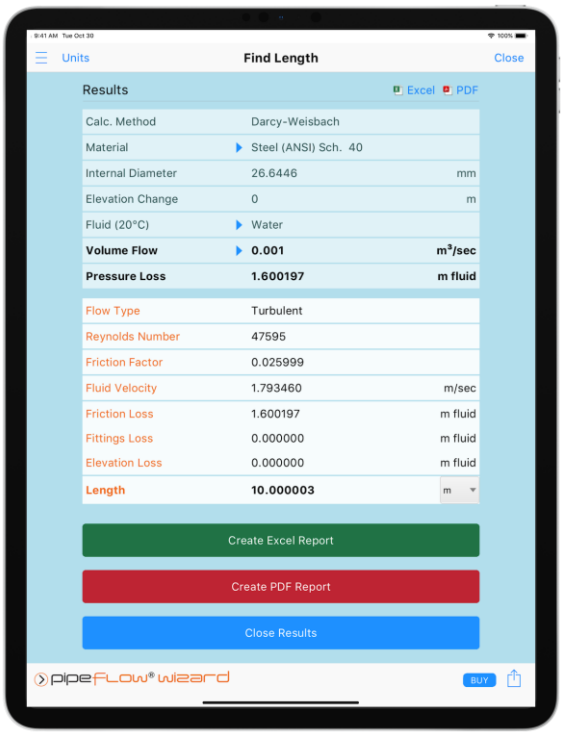
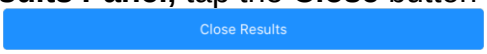


Figure 48 Find Length Results - Liquid

To close the **Results Panel,** tap the **Close** button in the **Navigation Bar** or the **Close Results** 

button at the bottom.

8.2 Pipe Length Calculation - Gas

The maximum length of a pipe which allows a required gas flow rate for a maximum allowable pressure loss can be calculated as follows:

1. Select the **Find Length** calculation.

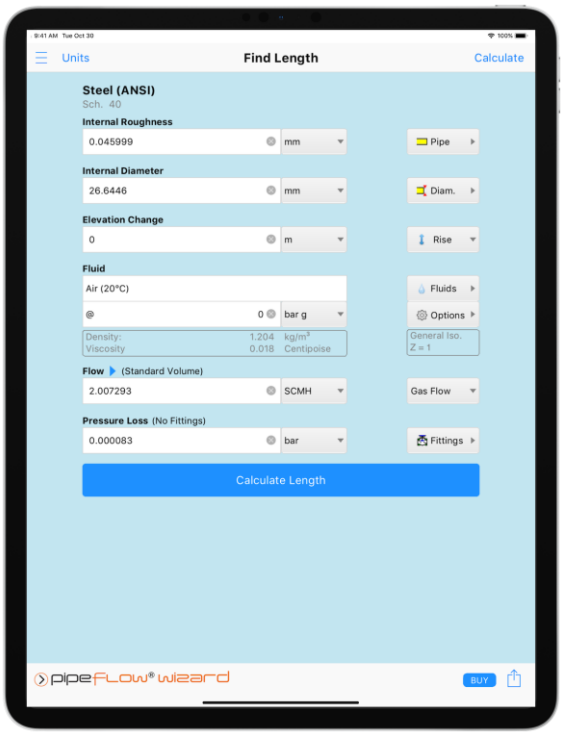


Figure 49 Find Length Calculation - Gas

2. Select or define the **Material** and **Internal Roughness** of the pipe. For more information about working with pipe materials, see: Pipe Material & Diameters.
3. Select or define the **Internal Diameter** of the pipe. For more information about working with pipe diameters, see: Pipe Material & Diameters.
4. Set the **Elevation Change** of the pipe.
5. Select the **Fluid** in the pipe. For more information about working with fluid, see: Fluids Database.
6. Enter the **Flow Rate** of the fluid in the pipe. For more information about setting a flow rate, see: Flow Rate Calculator / Helper.
7. Enter the **Pressure** of the fluid at the start of the pipe.
8. Enter the **Pressure Loss** in the pipe.
9. Add **Fittings** to the pipe if required. For more information about working with fittings, see: Fittings & Valves.
10. Tap **Calculate Length** and the **Results** panel will slide up.

The internal diameter will be reset to 1.049” (26.64 mm) if running the trial version of Pipe Flow Wizard.

The **Find Length Results Panel** displays the calculation input data and the results of the **Find Length** calculation. For more information about the Results Panel, see: Results Panel.

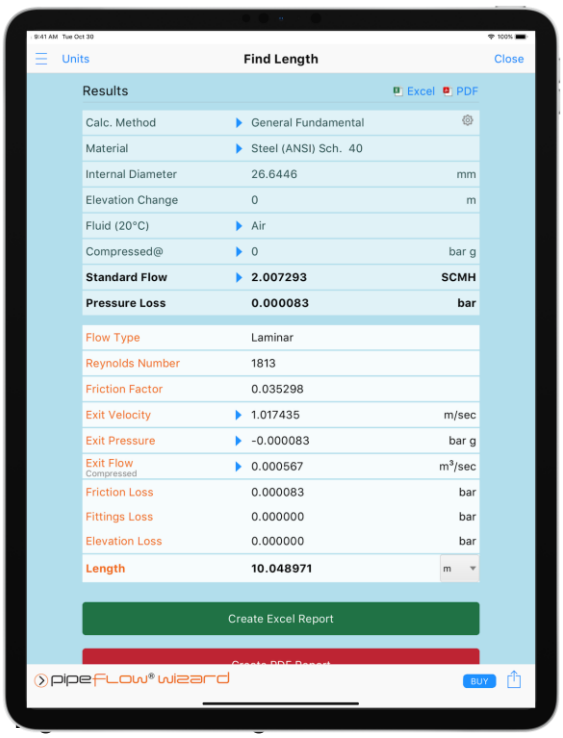
The **Length** units can be changed as required. To change the length units for all subsequent calculations, the length unit can be specified in Settings > Units. For more information about setting units, see: Units.

To generate and view an Excel or PDF Report of the results, tap the Excel button or PDF button. For more information about generating reports, see: Creating a Report of the Results.

To change the number of decimals the results are displayed to, tap the .000 **Results Decimals** button in the **Results Menu Bar**. For more information, see: Results Menu Bar.

To copy the calculation data to one or more other calculations, tap the Copy button and select the required calculation(s).

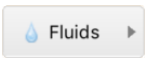
To close the **Results Panel,** tap the **Close** button in the **Navigation Bar** or the **Close Results** Close Results button at the bottom.



9 Fluids Database

The Pipe Flow Wizard software includes a fluid database. The Fluid Properties list displays all the fluids available in the fluid database for either liquids or gases. When you are selecting a fluid to be used for a calculation, you can select an existing fluid, or enter your own fluid data. Once entered, new fluid data will be displayed in the list of fluids and can then be used just the same as the standard fluid data.

To define the fluid and fluid properties for the currently selected calculation:

1. Tap the **Fluids** 

button on the calculation panel to display the Fluids Database Action Sheet.

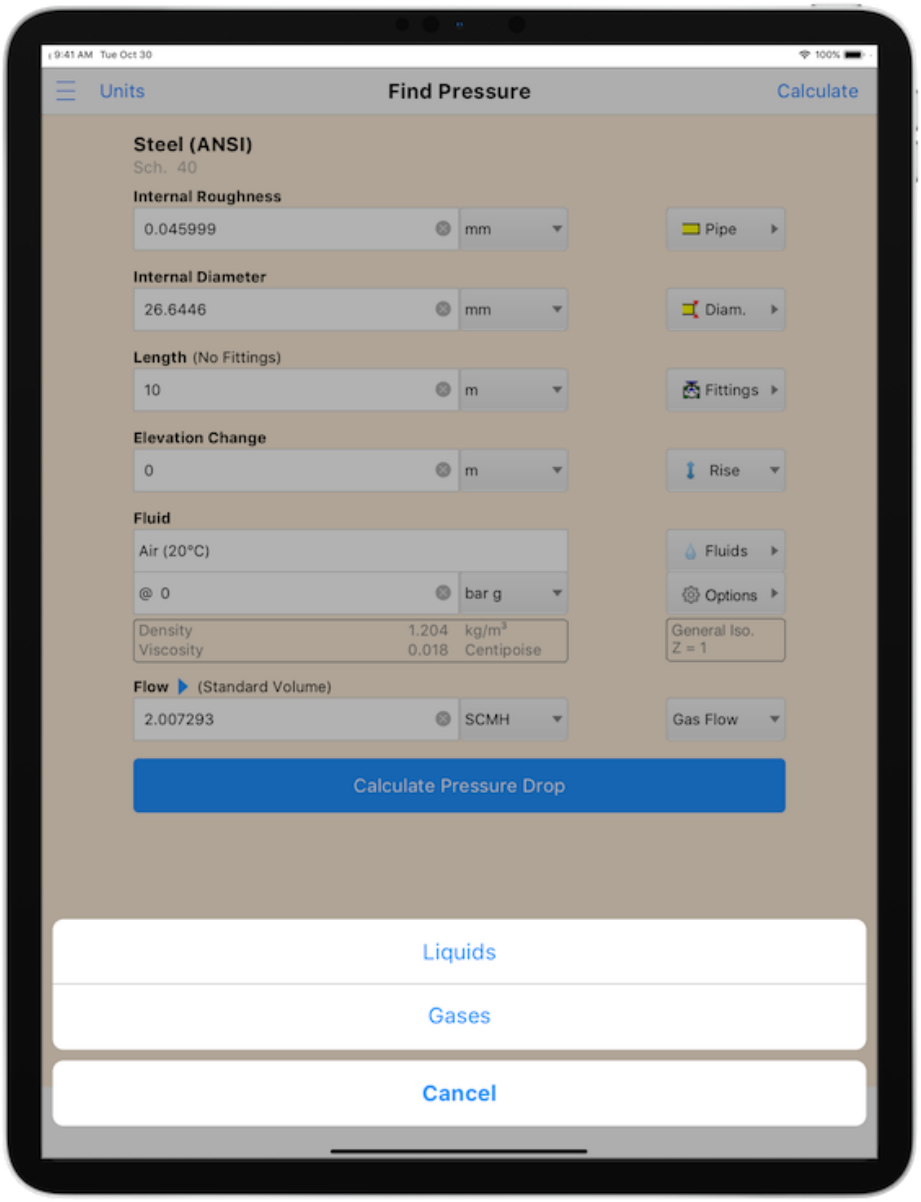


Figure 51 Fluids Database Action Sheet

2. Select either **Liquids** or **Gases** from the action sheet to display the required fluid database.

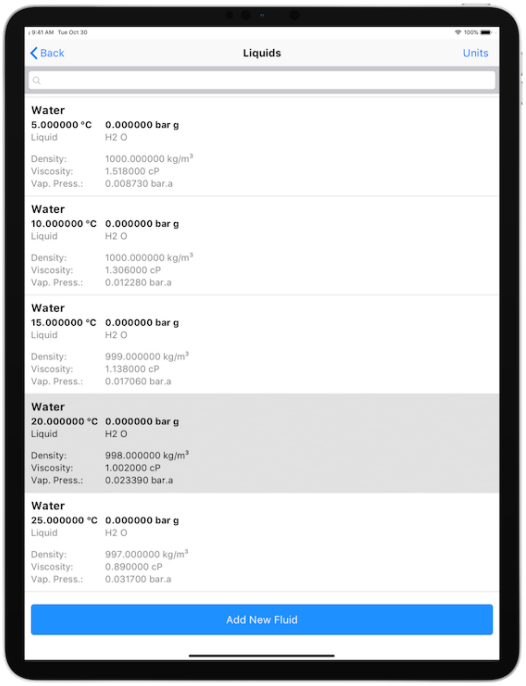


Figure 52 Fluid Database - Liquids

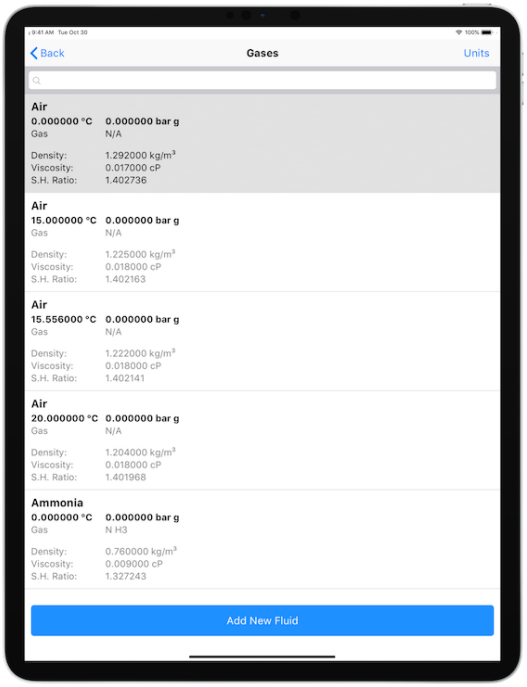


Figure 53 Fluid Database - Gases

3. Select the fluid contained in the pipe from the **Fluid Database** list.

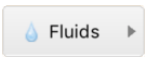
The name of the fluid is displayed in the calculation next to the fluid button.

9.1 Adding Fluid to the Fluid Database

If the fluid you are using does not exist in the Pipe Flow Wizard fluid database, you can quickly add the fluid to the database by tapping the Add Fluid button on the Fluids screen.

NOTE: Be sure to enter the value for the fluid's properties in the units displayed in the column header. For example, if you are using imperial units, °F for Fahrenheit is displayed under Temperature in the Temperature column. The temperature value in this case should be entered in degrees Fahrenheit.

To add a new fluid to the fluid database:

1. Tap the **Fluids** 

button on the calculation panel to display the Fluids Database Action Sheet.
2. Select either **Liquids** or **Gases** from the action sheet to display the required fluid database.

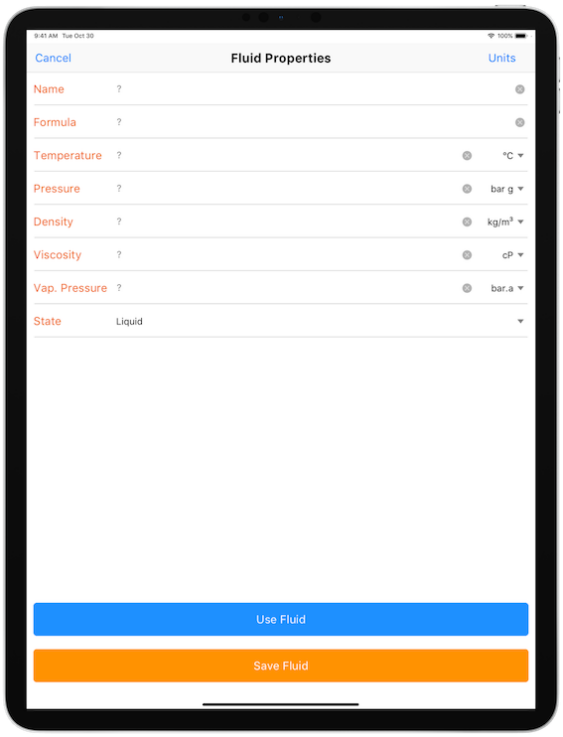


Figure 54 Fluid Properties

3. Tap the **Add New Fluid** button to display the **Fluid Properties** screen**.**
4. Enter the fluid's name in the **Name** field.
5. Enter the fluid's formula in the **Formula** field.
6. Enter the fluid's temperature in the **Temperature** field.
7. Enter the fluid's density in the **Density** field.

8. Enter the fluid's viscosity in the **Viscosity** field.
9. For a liquid, enter the fluid's vapor pressure in the **Vap. Pressure.** field.
10. For a gas, enter the fluid's specific heat ration in the **Specific Heat Ratio** field.
11. Select whether the fluid is a liquid or a gas in the **State** drop down field.
12. Tap the **Save Fluid** 

button to save the new fluid data to the **Fluid Database.**

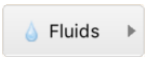
To use the defined fluid in the calculation without saving it to the database, tap the **Use Fluid** 

button.

9.2 Adding Gas Data to the Fluid Database

If the fluid you are using is one of the included gases, the viscosity and density of the gas at various temperatures and pressures can be calculated.

To add a new gas to the fluid database:

1. Tap the **Fluids** 

button on the calculation panel to display the Fluids Database Action Sheet.
2. Select **Gases** from the action sheet to display the list of standard gases.
3. Tap Add New Fluid and then select Use Gas Calculator or Use Own Data.

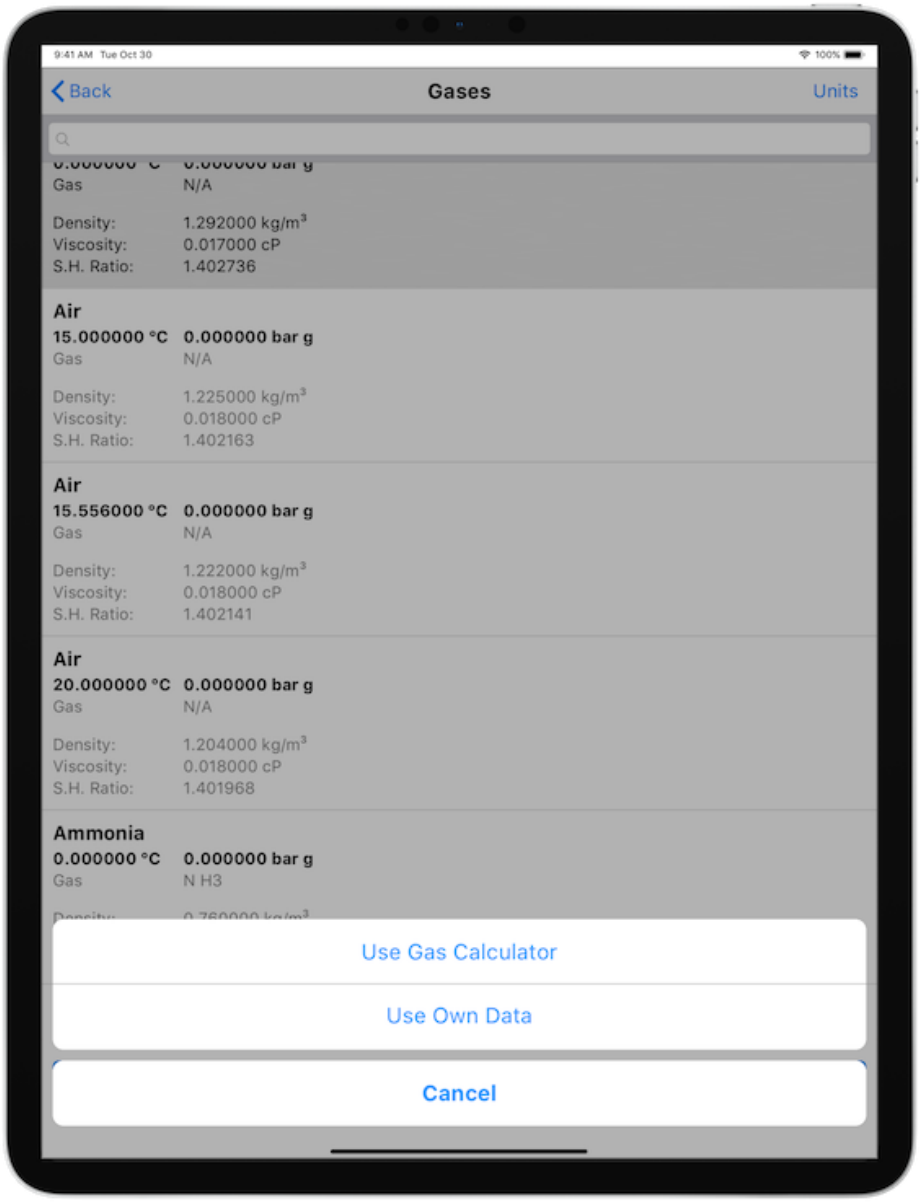


Figure 55 Gas Data Calculator

4. Tap the **Use Gas Calculation** menu item to display the **Gas Data Calculator.**

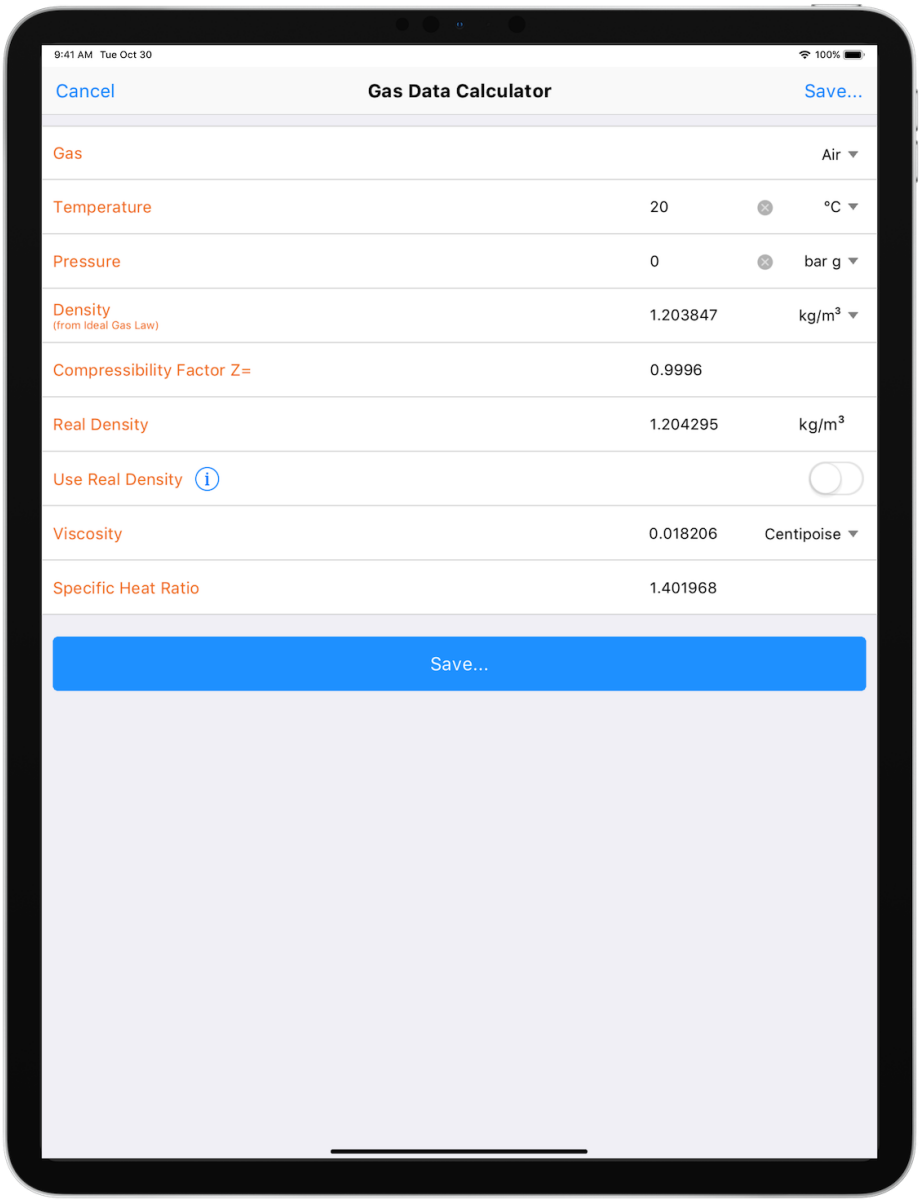


Figure 56 Gas Data Calculator

5. Choose a Gas from the drop-down listing.
6. Enter the temperature of the gas.
7. Enter the pressure condition.
8. Tap **Calculate Gas Data.**

The Gas Data Calculator will not generate fluid data if running the trial version of Pipe Flow Wizard.

9. The density, viscosity and specific heat ratio for the gas are displayed.
10. Tap **Save…** to display the Save action sheet

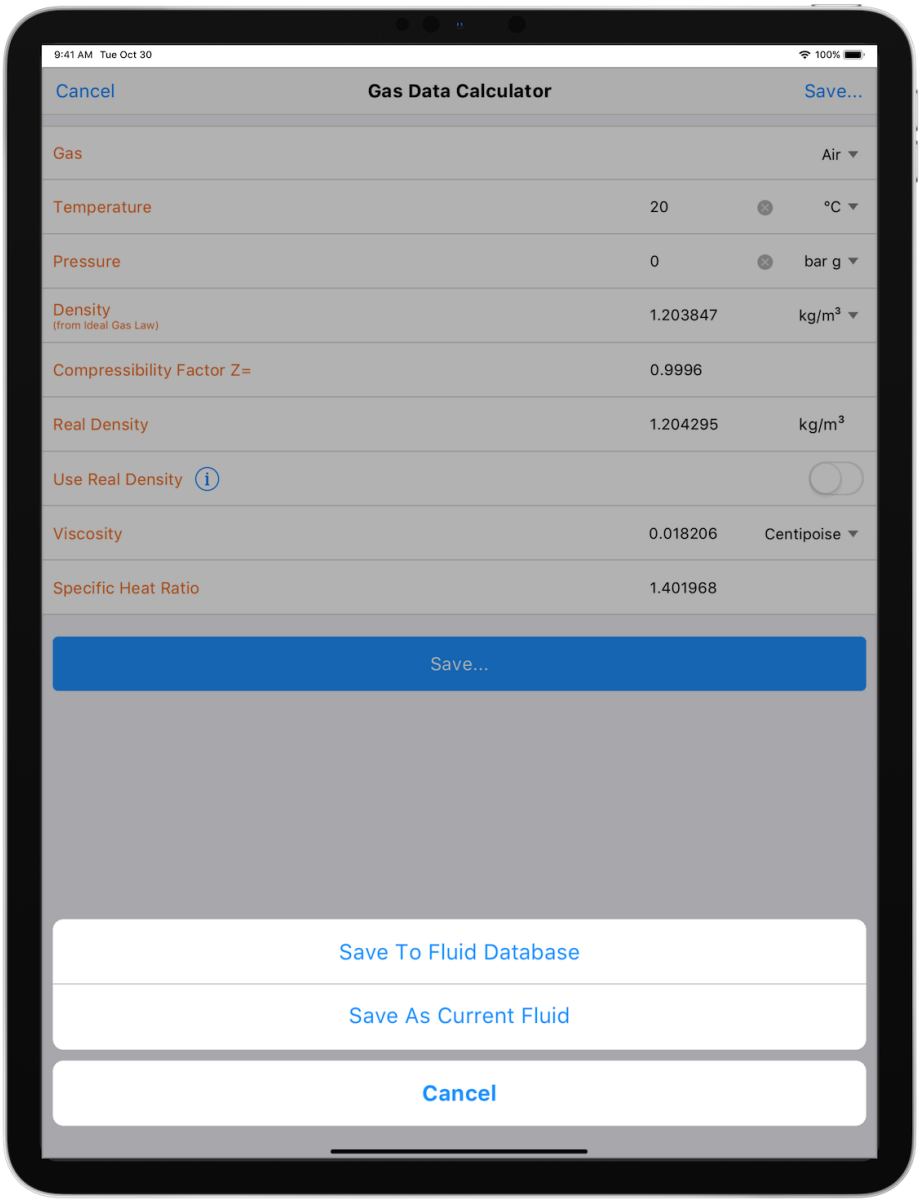


Figure 57 Gas Data Calculator Save Action Sheet

Tap **Save To Fluid Database** to save the new fluid data to the database**.**

Tap **Save As Current Fluid** to use the defined fluid in the calculation without saving it to the database.

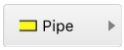
10 Pipe Material & Diameters

Pipe Flow Wizard includes a database of common pipe materials for which a range of pipe characteristics (internal roughness, nominal size and internal diameter) are defined.

If the pipe you are using does not exist in the database, then its characteristics can be entered manually and optionally added to the database.

10.1 Selecting a Pipe Material

To select a pipe material:

1. Tap the on the **Pipe** 

button on the calculation panel to open the **Pipe Material** screen.

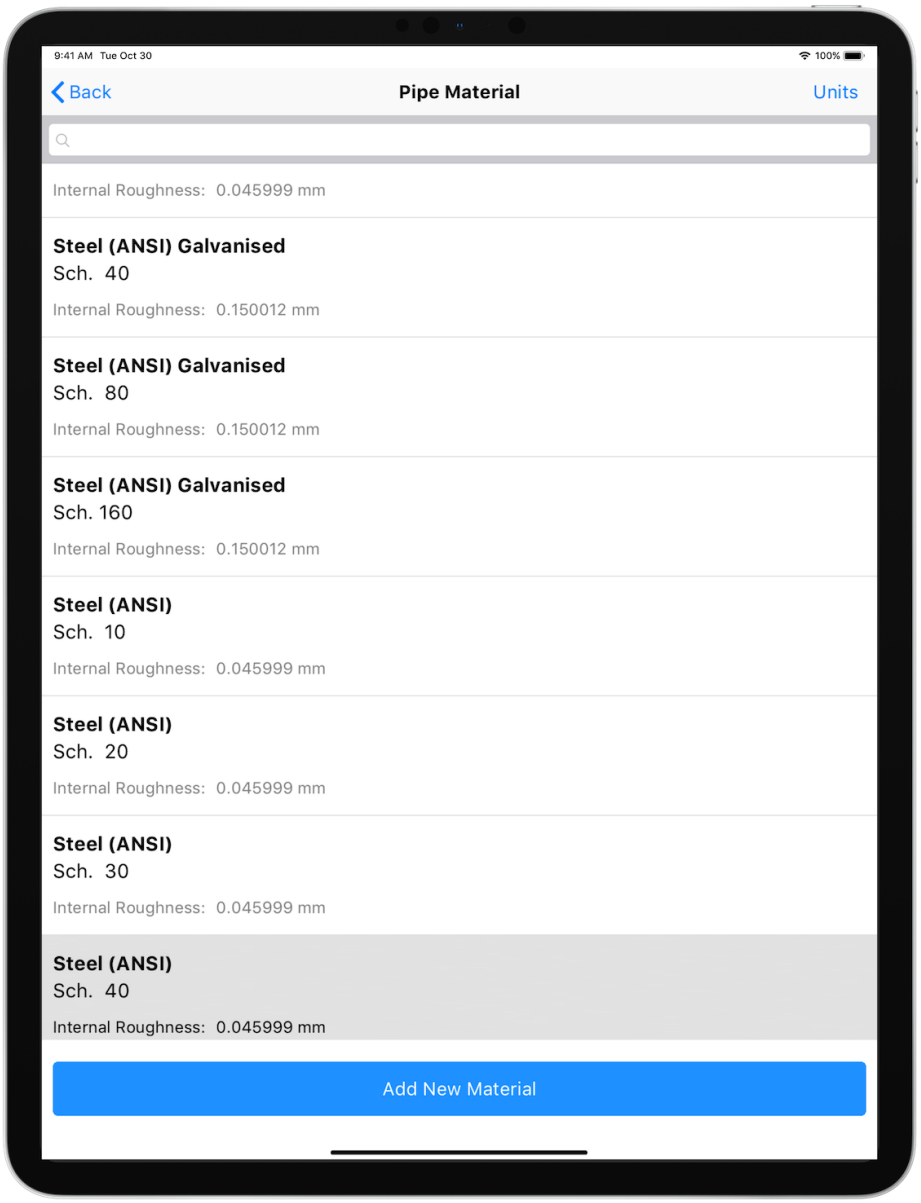
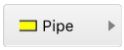


Figure 58 Pipe Material Database

Tap the required Material in the Material Database list.

10.2 Duplicating a Pipe Material

To select a pipe material:

1. Tap the on the **Pipe** 

button on the calculation panel to open the **Pipe Material** screen.
2. Swipe right to left on a material in the material database list to display the actions menu.

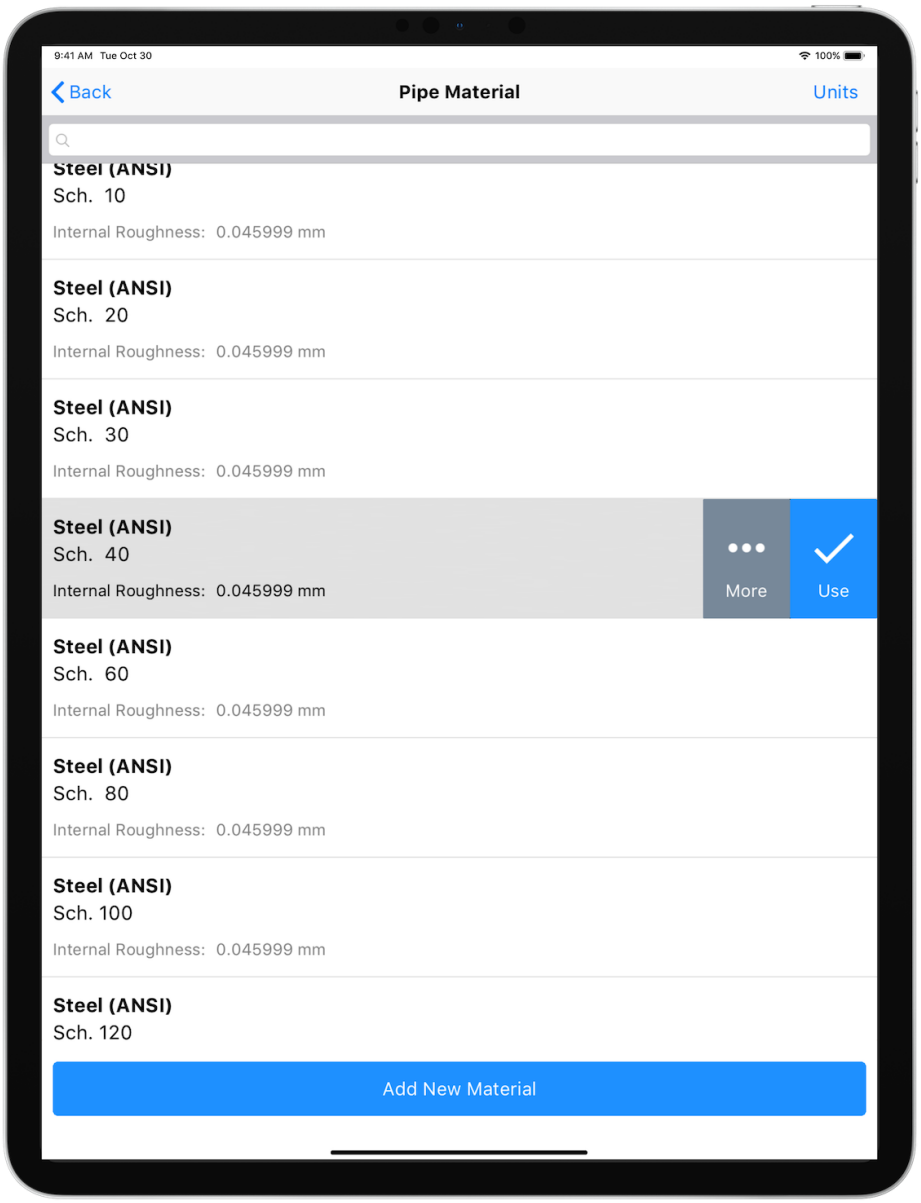


Figure 59 Pipe Material List Actions Menu

3. Tap the **More…** button to display the **Material Action Sheet.**

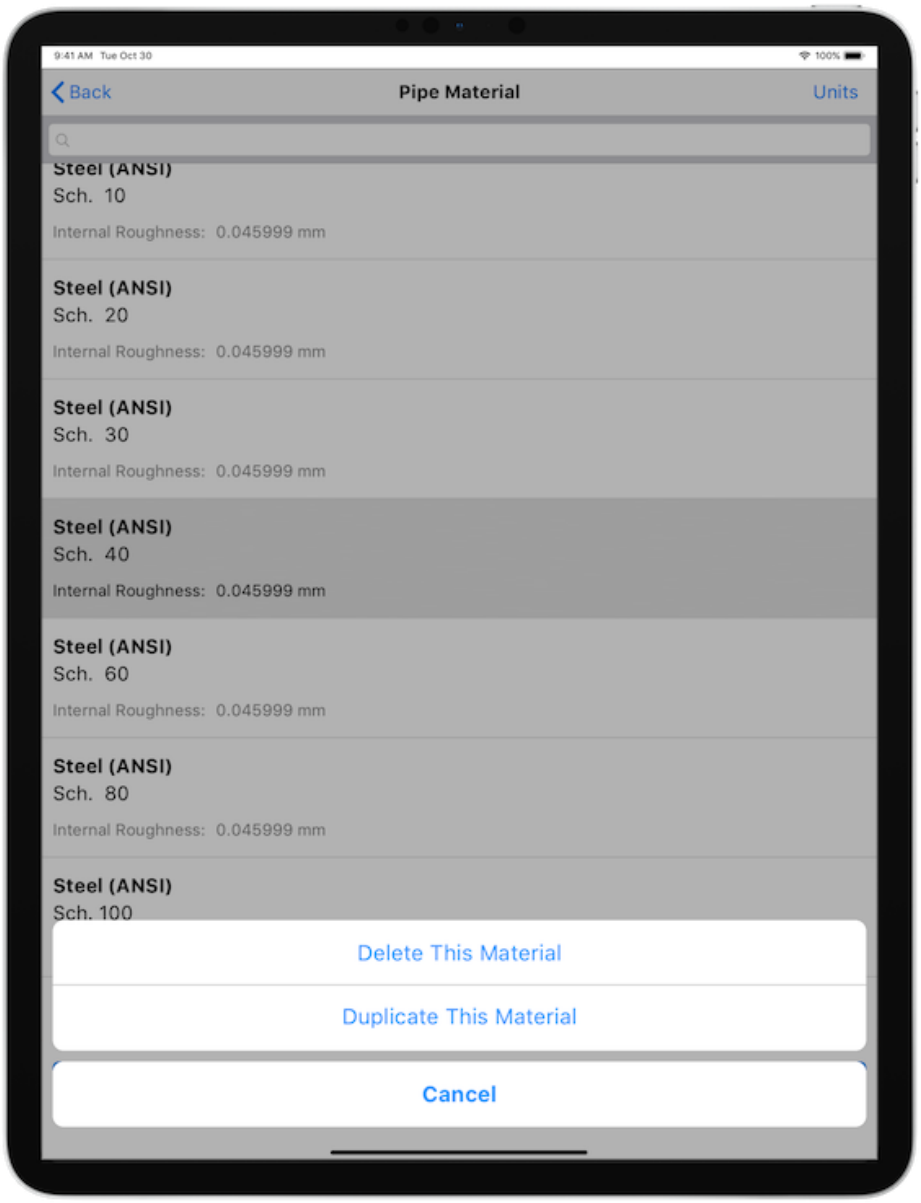


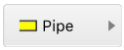
Figure 60 Material Database - Material Action Sheet

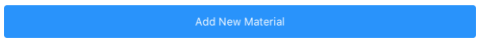
Tap the **Duplicate This Material** button to display the **Add New Material** screen with the field values pre-populated with the material to be duplicated.

4. Edit the **Name** field.
5. Edit the **Schedule / Class** field.
6. Edit the **Internal Roughness** field.
7. Tap the **Save Material** button to add the new material to the material database.

10.3 Adding a new Pipe Material

To select a pipe material:

1. Tap the on the **Pipe** 

button on the calculation panel to open the **Pipe Material** screen.
2. Tap the **Add New Material** 

button.

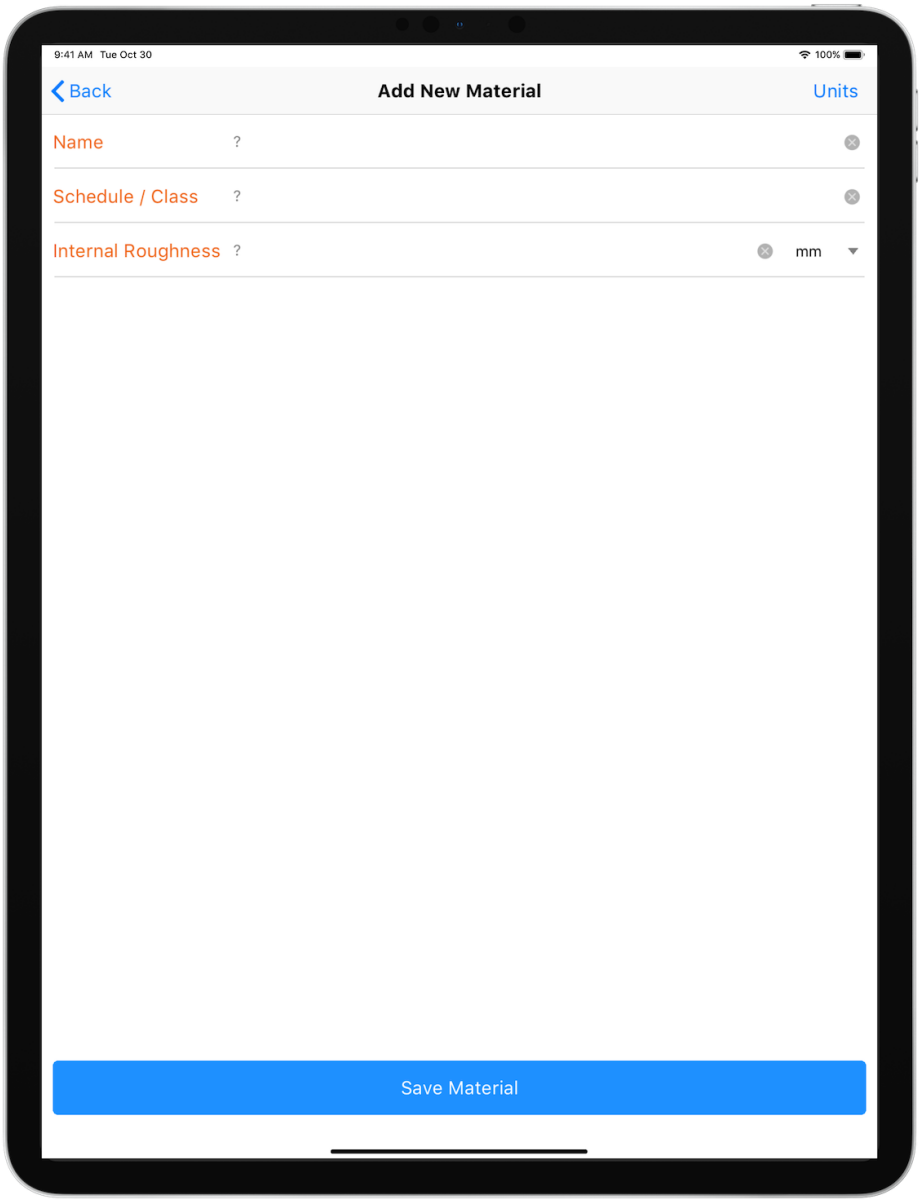


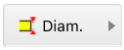
Figure 61 Add New Pipe Material

3. Enter the **Name**, **Schedule / Class**, and **Internal Roughness** values.

4. Tap the **Save Material** button to save the new material to the database.

10.4 Selecting a Pipe Diameter

To select a pipe diameter:

1. Tap the **Diam.** 

button on the calculation panel to open the **Pipe Diameter** screen.

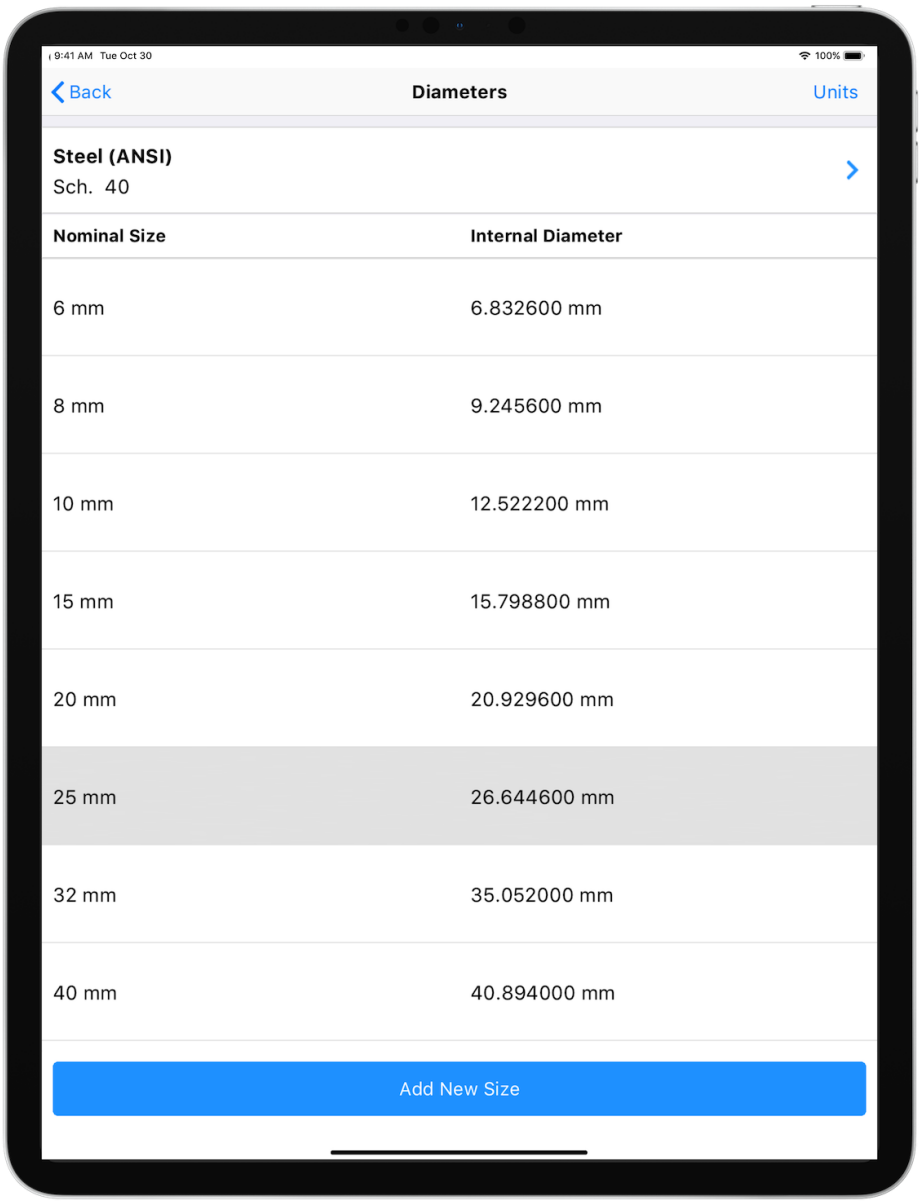


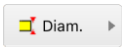
Figure 62 Pipe Diameter

2. If required, change the pipe material by tapping the currently selected material above the list of pipe diameters.

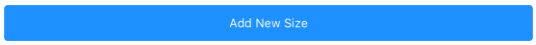
3. Tap the required **Diameter** in the **Pipe Diameter** database list.

10.5 Adding a Pipe Diameter

To add a new pipe diameter:

1. Tap the **Diam.** 

button on the calculation panel to open the **Pipe Diameter** screen.

2. Tap the **Add New Size** 

button.

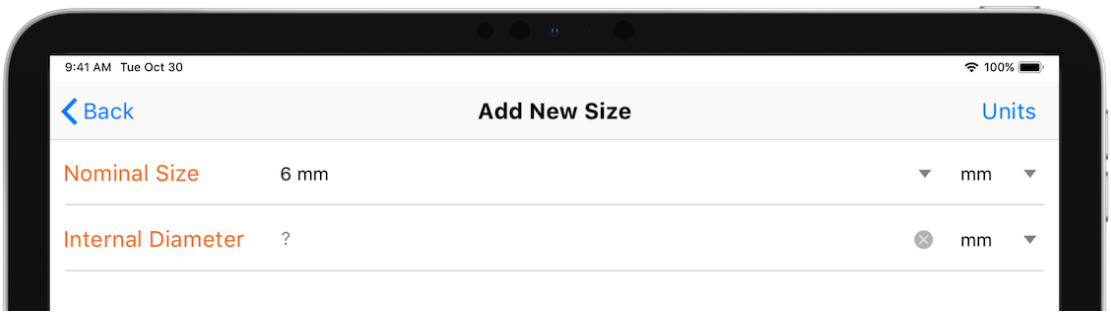
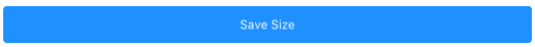


Figure 63 Add Pipe Diameter

3. Specify the **Nominal Size** and **Internal Diameter** values.

4. Tap the **Save Size** 

button**.**
Note: Pipe Flow Wizard will verify that the Nominal Size value and Internal Diameter value are equivalent, and if not, will prevent the new pipe diameter from being saved.

11 Fittings & Valves

Up to five different fitting types can be added to a pipe. Multiple fittings of each type can be specified, and each fitting type can be selected to be at the start or end of the pipe.

Fittings can be selected from the Pipe Flow Wizard Fitting database, or user fittings can be created using an appropriate K value.

11.1 Adding a Fitting to the Pipe

To add fittings to a pipe:

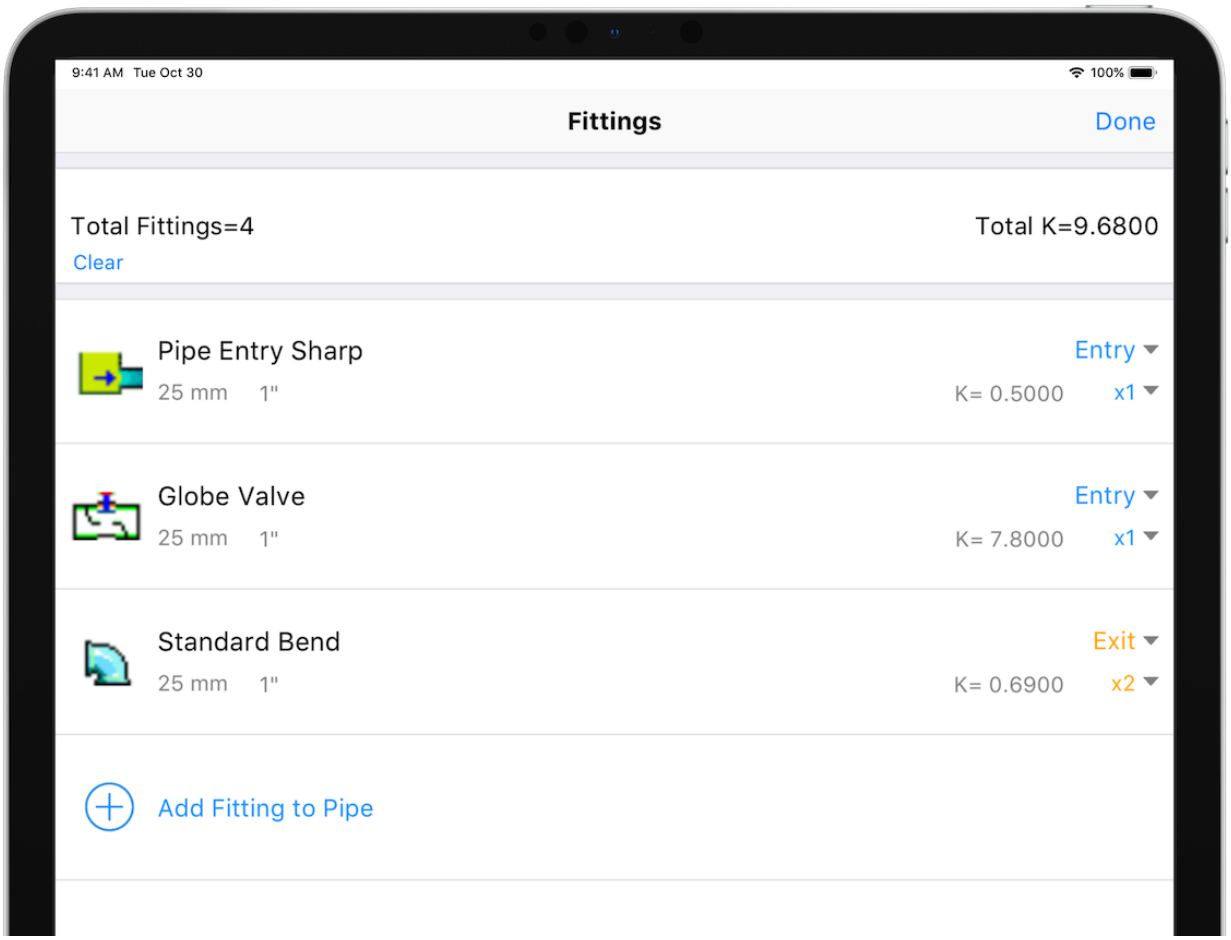
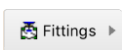


Figure 64 - Fittings & Valves

1. Tap the **Fittings**  button on the calculation panel to open the **Fittings** screen.

2. The fittings on the pipe will be shown.

3. Tap the **Add Fitting to Pipe** button to display the **Fitting Database.**

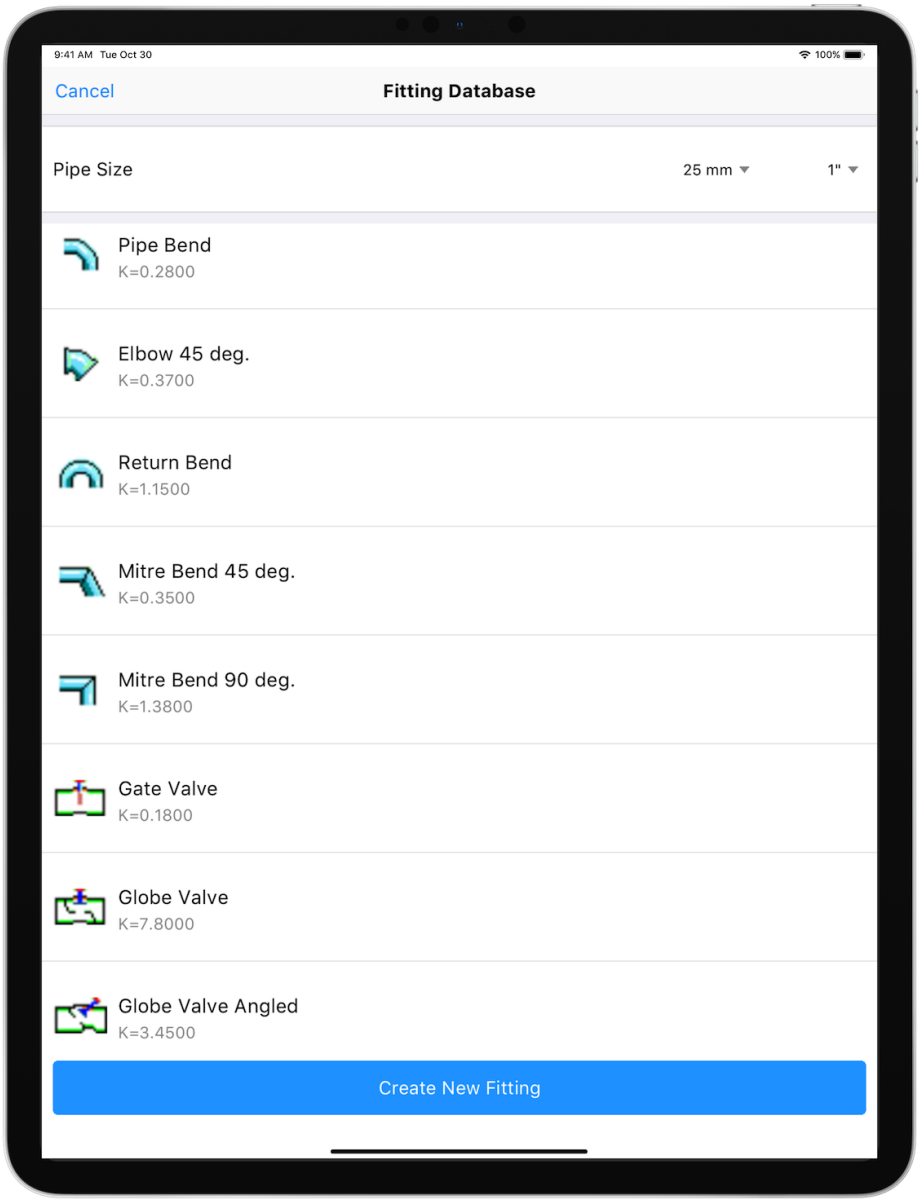


Figure 65 Fitting Database

A list of available fittings will be shown for the current pipe size.

4. If required, change the nominal size by selecting from the metric or imperial drop-down list, to display the available fittings and their associated K value for a different size**.**

5. If the fitting is not in the **Fitting Database** list, tap the **Create Fitting** button to add the new fitting to the list. For more information about adding a fitting to the database, see: Adding a Fitting to the Pipe.

6. Tap on a fitting from the list to add it to the fittings on the pipe.

7. The selected fitting is displayed in **Fittings** screen.

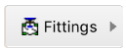
8. Select the position of the fitting on the pipe to be either Entry or Exit and select the quantity of each fitting from the Qty drop down list.

9. To add additional fittings to the pipe, repeat Steps 3 – 9.

10. Tap **Done** to add the chosen fittings to the pipe, and to close the **Fittings** screen.

11.2 Removing a Fitting from the Pipe

To remove fittings from a pipe:

1. Tap the **Fittings** 

button on the calculation panel to open the **Fittings** screen.

2. Swipe right to left on the fitting to be removed and tap **Remove**, or set the quantity for the fitting to be removed to zero.

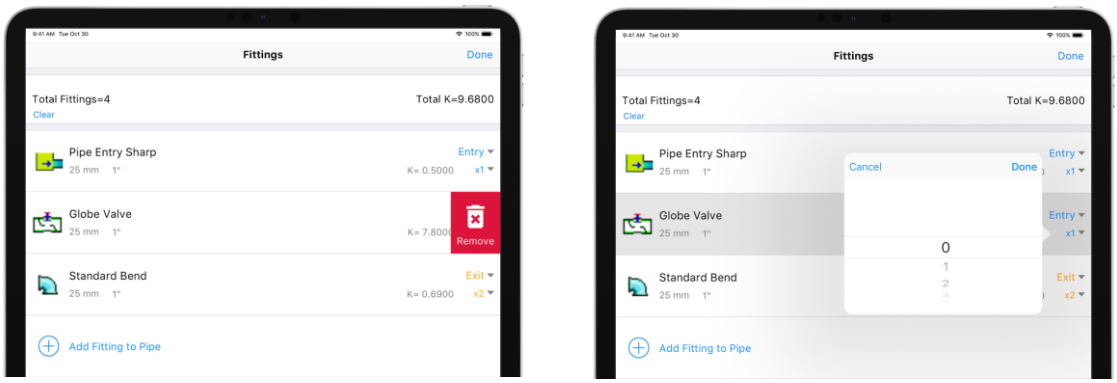
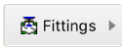


Figure 66 Remove Fitting from the Pipe

3. Tap **Done** to update the pipe with the chosen fittings, and to close the **Fittings** screen.

11.3 Adding a Fitting to the Database

To add a fitting to the database:

1. Tap the **Fittings** 

button on the calculation panel to open the **Fittings** screen.

2. Tap the **Create New Fitting** button to open the **Create New Fitting** screen.

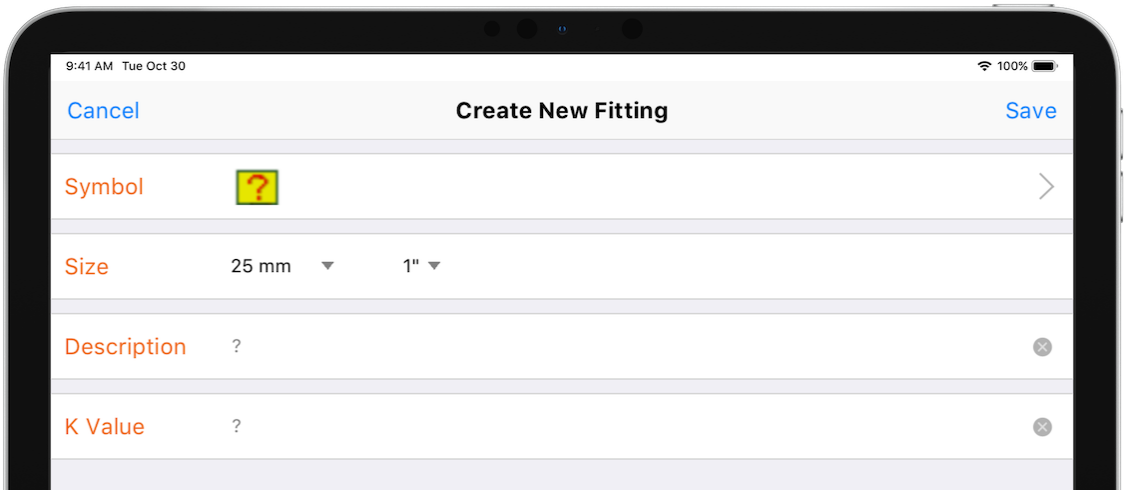


Figure 67 Create New Fitting

3. To change the symbol representing the fitting, tap the **Change** button to open the **Choose Symbol** screen.

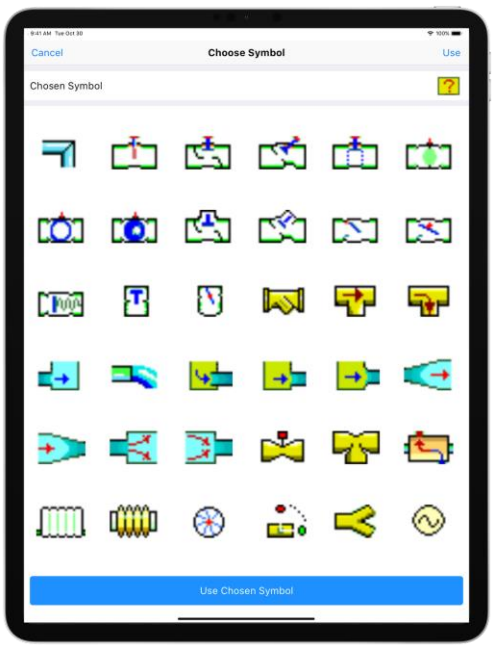


Figure 68 Choose Fitting Symbol

4. Select the symbol you want to represent the fitting.

5. Tap **Use Chosen Symbol** to add the symbol to the **Symbol** field and close the **Choose Symbol** screen.

6. Select the fitting's metric size from the **Metric** list or select the fitting's imperial size from the **Imperial** list.

7. You only need to select the metric or imperial fitting size. The Pipe Flow Wizard software automatically populates the other size for you. For example, if you select 32mm from the **Metric** list, the imperial equivalent, 1-1/4", automatically appears in the **Imperial** field.

8. Enter a description of the fitting in the **Description** field.

9. Enter the K value for the fitting in the **K Value** field.

10. Tap the **Save Fitting** to add the fitting to the **Fitting Database** list.

Scroll down to reveal additional symbols.

12 Flow Rate Calculator / Helper

For Pressure Drop Calculation and Pipe Length Calculation, Pipe Flow Wizard incorporates a Flow Rate Calculator which uses the current internal diameter and a fluid velocity to calculate a flow rate.

To open the **Flow Rate Calculator:**

1. Tap the Flow  expander button:

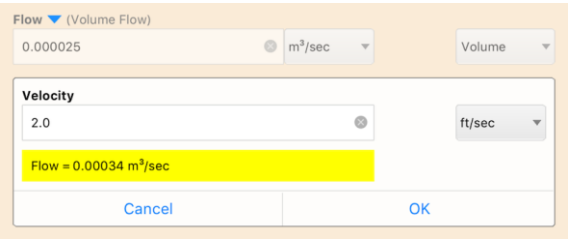


Figure 70 Flow Calculator - Liquid

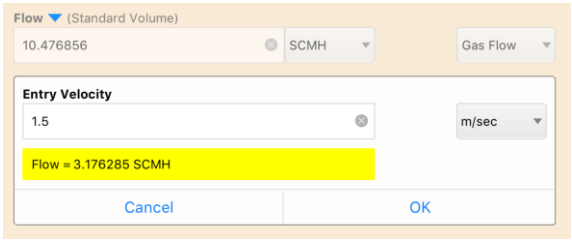


Figure 69 Flow Calculator - Gas

2. Enter the required **Velocity**.

3. As you enter the **Velocity,** Pipe Flow Wizard automatically calculates the **Flow Rate** and displays it beneath the velocity.

4. Tap **OK** to apply the calculated flow rate and close the **Flow Rate Calculator.**

Whilst the **Flow Rate Calculator** is open, no other operations can be performed in the calculation panel.

13 Calculations and Results

Once you have entered the required input data to a Calculation Panel (e.g. Find Pressure), you can calculate the results for by tapping the **Calculate** button. If the input data is valid, the Results Panel slides up and over the Calculation Panel to concisely display the calculated data.

The values in the results panel can be scrolled up and down as needed, and where applicable, a result value can be expanded to reveal additional information related to that attribute. For more information about expanding attributes, see: Expandable Sections.

13.1 Automatic Checks and Updates

Before a calculation is solved, the software performs some automatic checking of the input data and allows users to accept various recommended updates to the make the calculation data consistent.

13.1.1 Fitting Sizes

Fitting sizes will be checked and matched to the nominal pipe size.

Figure 71 Fitting Sizes

If the nominal pipe size does not match some of the fitting sizes associated with the pipe, then the option to update the fittings sizes should normally be accepted. This will update the fitting sizes and the fitting 'K' values so that the correct data for the given pipe size is used, such that the pressure losses will be appropriately calculated.

Pipe Flow Wizard cannot automatically update fitting sizes for user defined fittings.

13.2 Configuring the System Results

Once a calculation has been solved, the calculated results are displayed in the Results Panel. The options selected in the Results Decimals and Units sections of Settings determine how the results values are displayed.

13.3 Copying Calculation Results for use in another Calculation

When a calculation has been solved and the results panel is on display, tap the **Share** button to display the **Results Panel Share Action Sheet.**

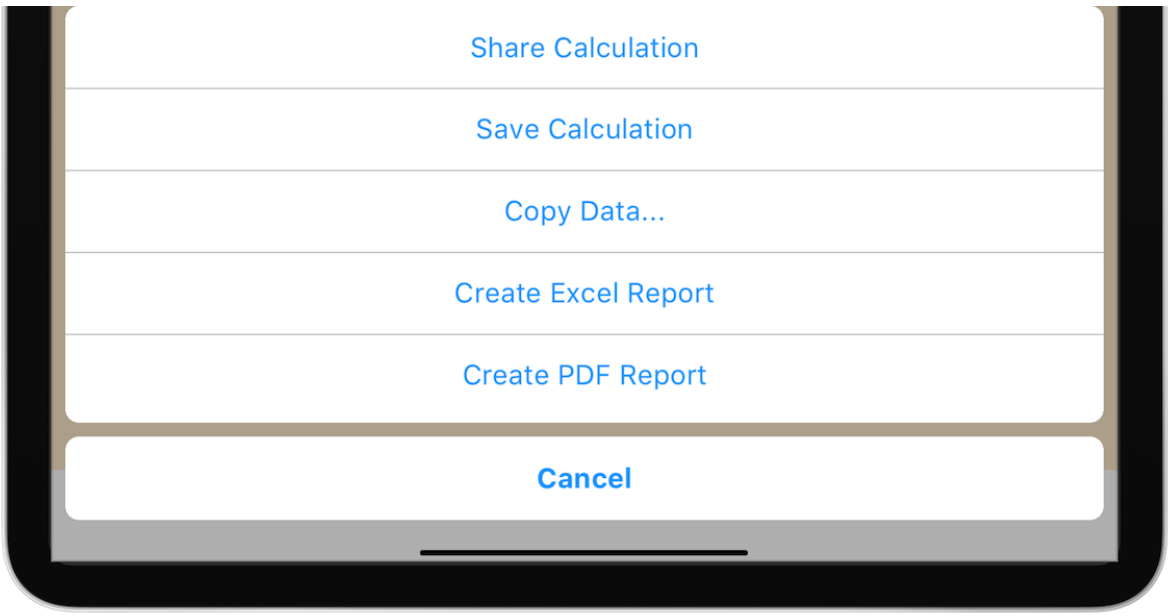


Figure 72 Results Panel Share Action Sheet

Tap **Copy Data…** to display the **Copy Calculation Action Sheet**.

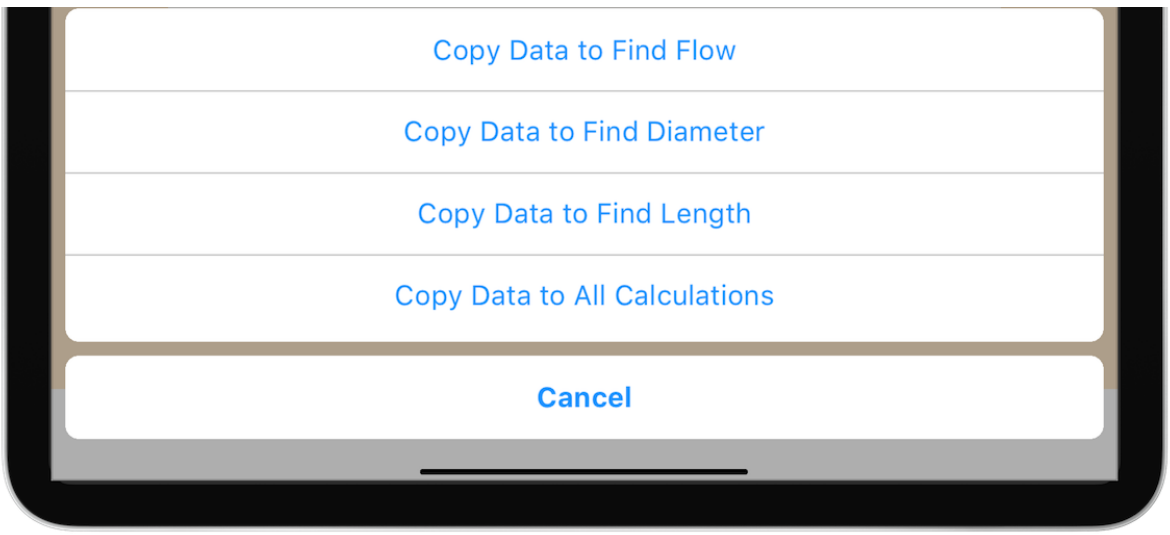


Figure 73 Copy Calculation Action Sheet

Tap a menu item to copy the current calculation data to the input data of a different calculation, or copy it as the input data for all other calculations.

13.4 Creating a Report of the Results

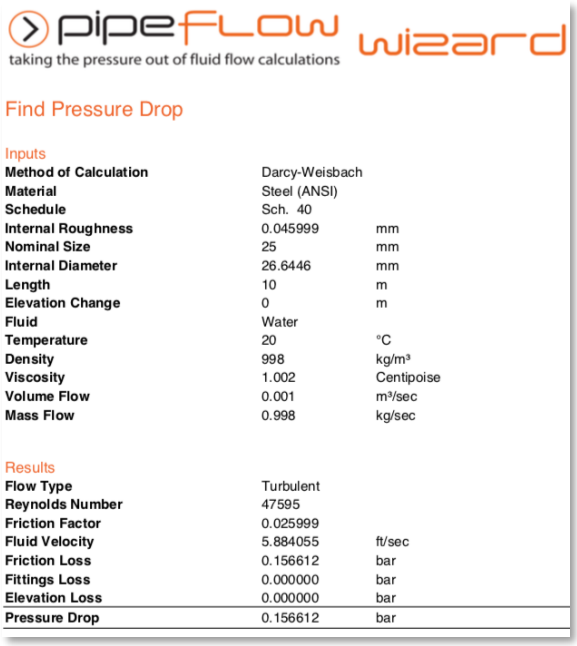
When a calculation has been solved and the **Results Panel** displayed, an Excel or PDF report can be created.

To create an Excel Report, tap the **Excel** button. The report will be generated using the defined Reports settings and the Pipe Flow Wizard software will attempt to open it using **Microsoft Excel** (or compatible software) that is installed on your computer.

To create a PDF Report, tap the **PDF** button. The report will be generated using the defined Reports settings and Pipe Flow Wizard will attempt to open it using **Adobe Acrobat** (or compatible software) that is installed on your computer.

The options selected in the Results Decimals, Units and Reports sections of Settings determine how the results values are displayed.

13.5 PDF Report Example – Tabulated Units



pipeFLOW wizard
taking the pressure out of fluid flow calculations

Find Pressure Drop

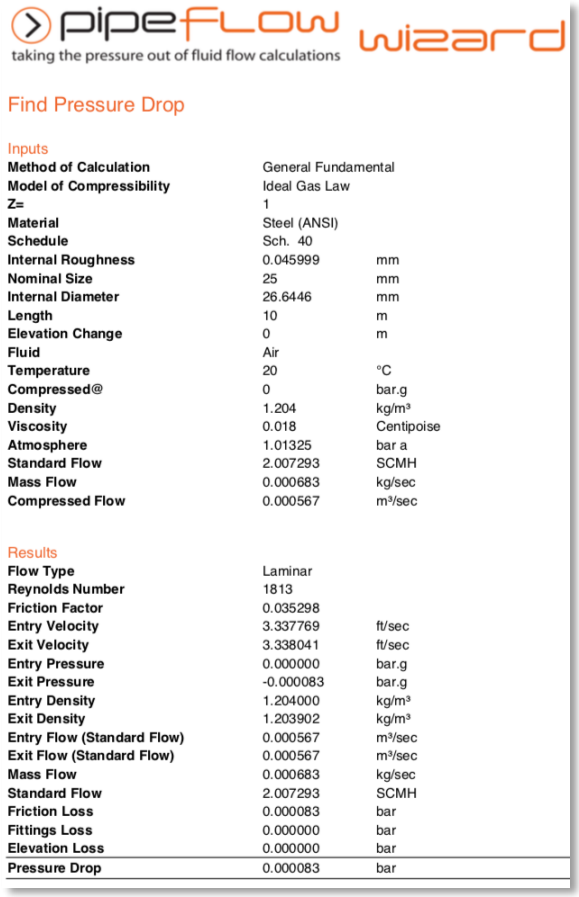
Inputs

Method of Calculation	Darcy-Weisbach	
Material	Steel (ANSI)	
Schedule	Sch. 40	
Internal Roughness	0.045999	mm
Nominal Size	25	mm
Internal Diameter	26.6446	mm
Length	10	m
Elevation Change	0	m
Fluid	Water	
Temperature	20	°C
Density	998	kg/m³
Viscosity	1.002	Centipoise
Volume Flow	0.001	m³/sec
Mass Flow	0.998	kg/sec

Results

Flow Type	Turbulent	
Reynolds Number	47595	
Friction Factor	0.025999	
Fluid Velocity	5.884055	ft/sec
Friction Loss	0.156612	bar
Fittings Loss	0.000000	bar
Elevation Loss	0.000000	bar
Pressure Drop	0.156612	bar

Figure 74 PDF Report - Tabulated - Liquid



pipeFLOW wizard
taking the pressure out of fluid flow calculations

Find Pressure Drop

Inputs

Method of Calculation	General Fundamental	
Model of Compressibility	Ideal Gas Law	
Z=	1	
Material	Steel (ANSI)	
Schedule	Sch. 40	
Internal Roughness	0.045999	mm
Nominal Size	25	mm
Internal Diameter	26.6446	mm
Length	10	m
Elevation Change	0	m
Fluid	Air	
Temperature	20	°C
Compressed@	0	bar.g
Density	1.204	kg/m³
Viscosity	0.018	Centipoise
Atmosphere	1.01325	bar a
Standard Flow	2.007293	SCMH
Mass Flow	0.000683	kg/sec
Compressed Flow	0.000567	m³/sec

Results

Flow Type	Laminar	
Reynolds Number	1813	
Friction Factor	0.035298	
Entry Velocity	3.337769	ft/sec
Exit Velocity	3.338041	ft/sec
Entry Pressure	0.000000	bar.g
Exit Pressure	-0.000083	bar.g
Entry Density	1.204000	kg/m³
Exit Density	1.203902	kg/m³
Entry Flow (Standard Flow)	0.000567	m³/sec
Exit Flow (Standard Flow)	0.000567	m³/sec
Mass Flow	0.000683	kg/sec
Standard Flow	2.007293	SCMH
Friction Loss	0.000083	bar
Fittings Loss	0.000000	bar
Elevation Loss	0.000000	bar
Pressure Drop	0.000083	bar

Figure 75 PDF Report - Tabulated - Gas

13.6 PDF Report Example – Non-Tabulated Units

pipeFLOW wizard
taking the pressure out of fluid flow calculations

Find Pressure Drop

Inputs

Method of Calculation	Darcy-Weisbach
Material	Steel (ANSI)
Schedule	Sch. 40
Internal Roughness	0.045999 mm
Nominal Size	25 mm
Internal Diameter	26.644600 mm
Length	10.000000 m
Elevation Change	0.000000 m
Fluid	Water
Temperature	20°C
Density	998.000000 kg/m³
Viscosity	1.002000 Centipoise
Volume Flow	0.001 m³/sec
Mass Flow	0.998 kg/sec

Results

Flow Type	Turbulent
Reynolds Number	47595
Friction Factor	0.025999
Fluid Velocity	5.884055 ft/sec
Friction Loss	0.156612 bar
Fittings Loss	0.000000 bar
Elevation Loss	0.000000 bar
Pressure Drop	0.156612 bar

Figure 76 PDF Report - Non-Tabulated - Liquid

pipeFLOW wizard
taking the pressure out of fluid flow calculations

Find Pressure Drop

Inputs

Method of Calculation	General Fundamental
Model of Compressibility	Ideal Gas Law
Z=	1
Material	Steel (ANSI)
Schedule	Sch. 40
Internal Roughness	0.045999 mm
Nominal Size	25 mm
Internal Diameter	26.644600 mm
Length	10.000000 m
Elevation Change	0.000000 m
Fluid	Air
Temperature	20°C
Compressed@	0.000000 bar g
Density	1.204000 kg/m³
Viscosity	0.018000 Centipoise
Atmosphere	1.013250 bar a
Standard Flow	2.007293 SCMH
Mass Flow	0.000683 kg/sec
Compressed Flow	0.000567 m³/sec

Results

Flow Type	Laminar
Reynolds Number	1813
Friction Factor	0.035298
Entry Velocity	3.337769 ft/sec
Exit Velocity	3.338041 ft/sec
Entry Pressure	0.000000 bar g
Exit Pressure	-0.000083 bar g
Entry Density	1.204000 kg/m³
Exit Density	1.203902 kg/m³
Entry Flow (Standard Flow)	0.000567 m³/sec
Exit Flow (Standard Flow)	0.000567 m³/sec
Mass Flow	0.000683 kg/sec
Standard Flow	2.007293 SCMH
Friction Loss	0.000083 bar
Fittings Loss	0.000000 bar
Elevation Loss	0.000000 bar
Pressure Drop	0.000083 bar

Figure 77 PDF Report - Non-Tabulated - Gas

14 Working with Compressible Fluids

The Pipe Flow Wizard software contains a Compressible Isothermal Flow Calculation Engine.

In a gas system, as pressure loss occurs along a pipe, the gas density will decrease, and the volume of the gas will expand. As the volume of gas increases, the velocity of the gas in the pipe will increase. Although the volume of gas and velocity in the pipe changes, the mass flow (weight of flow) in the pipe will remain constant.

Gas flow rates are therefore often referred to in terms of mass flow (weight of flow) or standard volume (which is the volume of gas at standard conditions, normally atmospheric pressure and some common temperature reference, since this standard volume also defines a constant mass flow).

Pipe Flow Wizard provides a choice of standard volume units for gas flow rate which include:

- SCCM (Standard Cubic Centimetres per Minute),
- SLM (Standard Litres per Minute),
- SCMH (Standard Cubic Meters per Hour)
- MMSCMH (Million Standard Cubic Meters per Hour)
- MMSCMD (Million Standard Cubic Meters per Day)
- SCFM (Standard Cubic Feet per Minute)
- SCFH (Standard Cubic Feet per Hour)
- SCFD (Standard Cubic Feet per Day)
- MMSCFH (Million Standard Cubic Feet per Hour)
- MMSCFD (Million Standard Cubic Feet per Day)

Each of the standard volume units for gas flow relate to the gas at a standard condition, however there are several slightly different standard reference conditions that are used worldwide depending on country and location. Pipe Flow Wizard provides a choice of standard reference conditions to be used when referring to the standard volume flow rate of gas and these include:

- 0°C, 100.000 kPa.a
- 0°C, 101.325 kPa.a
- 15°C, 101.325 kPa.a
- 20°C, 101.325 kPa.a
- 25°C, 101.225 kPa.a
- 60°F, 14.696 psi.a
- 68°F, 14.696 psi.a

Mass flow can also be used to refer to an amount of gas flow and the units for mass flow include:

- kg/sec
- kg/min
- kg/hour
- lb/sec
- lb/min
- lb/hour

14.1 Defining Gas Data

The calculations incorporate use of the Ideal Gas Law and if required a custom Compressibility Factor or use of the CNGA Compressibility Factor (that is calculated based on the pressures at the start and end of the pipe).

The Compressible Flow Calculation Engine will automatically take account of pressure changes within the pipe and will automatically adjust the density properties of the gas as appropriate when performing the gas flow rate, pressure loss, diameter size, and pipe length calculations. The equations used in the calculations currently assume isothermal flow where there is no change in temperature.

The Pipe Flow Wizard software will automatically account for changes in pressure and gas density within the pipe, however the original fluid properties must be defined for the operating temperature within the pipe (although the density may have been specified for a different pressure condition).

Normally the gas properties should be defined for the atmospheric pressure condition (0 bar.g or 0 psi.g) and the software will then automatically calculate the gas density at the start pressure condition prior to performing the appropriate calculation.

If the start pressure is a high pressure, and the real gas density at this condition varies from the ideal gas law prediction, then a compressibility factor other than 1.0 can be specified. This will be applied when calculating the gas density at the start pressure condition prior to performing the appropriate calculation.

14.1.1 Gas Calculator Data

The gas calculator helper within the Fluid Database can calculate and display the compressibility factor of certain gases at different temperature and pressure conditions, and it will show the real density of the gas at the specified condition.

The user should choose to either:

1. Define the gas properties at a condition on the ideal gas law line (normally say 0 bar.g) and then specify on the Options screen an appropriate compressibility factor for the pressure condition at the start of pipe.

   OR

2. Define the gas properties at the start pressure condition using the real gas density at this pressure (if it differs from the predicted ideal gas law density at this condition) and then specify the compressibility ‘Z=1.0’.

This ensures that the calculation proceeds to use the correct real gas density at the start pressure condition.

i.e.

a) If the gas properties are specified on the ideal gas law line then the predicted gas density at the start pressure condition will then be adjusted according to the compressibility factor that has been specified, in order to end up with the real gas density at the start condition.

OR

b) If the gas properties are defined at a high-pressure condition, specifying the real gas density, then a compressibility factor of ‘Z=1.0’ should be used. The calculated density at the start pressure condition will then be derived from the real gas density (at the high-pressure condition) by applying the ideal gas law equation. This will normally give a good result in terms of predicting the real gas density at the start of the pipe, provided that the defined high-pressure condition and the start pressure are not too different.

This means that the gas properties should generally be specified on the ideal gas law line and a compressibility factor can be specified as appropriate, or if the real gas density is specified for the gas at a high-pressure condition at the start of the pipe then the compressibility factor should be set to 1.0.

14.2 Using Compressible Flow Equations

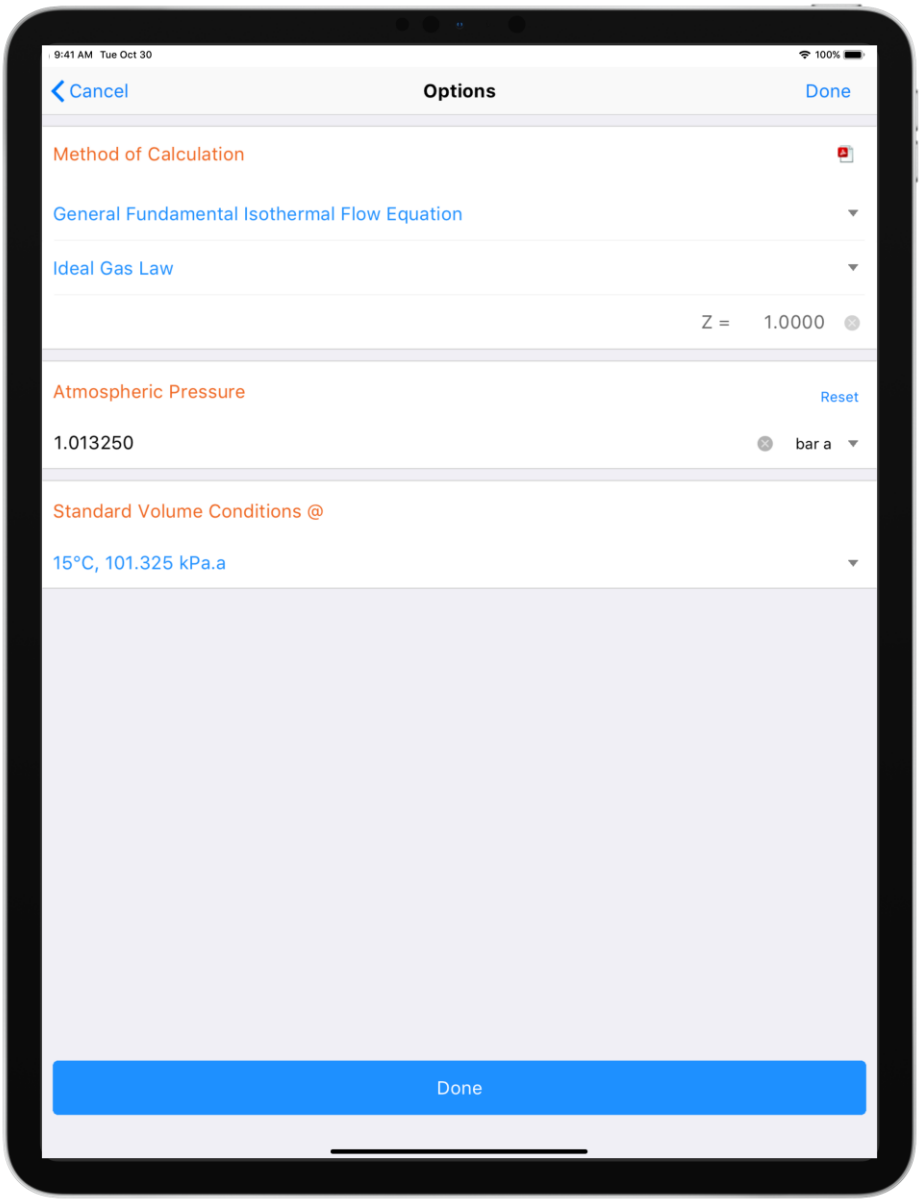


Figure 78 Compressible Flow Equations

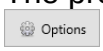
There are a number of different equations that can be used to calculate flow rate and pressure loss in a compressible gas system and the type of design and user preference often determines which equation is used to calculate the results.

The Pipe Flow Wizard software allows for the selection of a specific compressible isothermal flow equation from a list that includes:

- General Fundamental Isothermal Flow Equation
- Complete Isothermal Flow Equation
- AGA Isothermal Flow Equation
- Weymouth Isothermal Flow Equation

- Panhandle A Isothermal Flow Equation
- Panhandle B Isothermal Flow Equation
- IGT Isothermal Flow Equation

The General Fundamental Isothermal Flow Equation (sometimes known as just the General Flow equation or the Fundamental Flow equation) provides perhaps the most universal method for calculating isothermal flow rates, however it relies on the inclusion of an accurate friction factor. The Pipe Flow Wizard software provides such a friction factor by calculating this using the Colebrook-White equation.

The preferred method of calculation can be selected from by tapping the **Options** 

button on the calculation panel.

15 Calculation Theory and Method of Solutions

The Pipe Flow Wizard software allows you to calculate the pressure loss, or the flow rate, or the required pipe diameter size, or the applicable pipe length, depending on what other information is known. The reported results include flow rates, fluid velocities, Reynolds numbers, friction factors, friction pressure loss, fittings, pressure losses and more.

15.1 Fluid Flow States

Fluids in motion are subjected to various resistance forces, which are due to friction. Friction may occur between the fluid and the pipe work, but friction also occurs within the fluid as sliding between adjacent layers of the fluid takes place.

The friction within the fluid is due to the fluid's viscosity. When fluids have a high viscosity, the speed of the flow tends to be low, and resistance to flow becomes almost totally dependent on the viscosity of the fluid. The condition is known as 'Laminar flow'.

Fluids which have a low viscosity are usually moving at higher velocities. The flow characteristics change, small eddy currents occur within the flow stream, and the friction between the pipe work and the fluid becomes a factor to be considered. This type of flow is known as 'Turbulent flow'.

15.2 Fluid Viscosity

A fluid viscosity can be described by its Dynamic viscosity (sometimes called Absolute viscosity), or it's Kinematic viscosity. These two expressions of viscosity are not the same but are linked via the fluid density.

Kinematic viscosity = Dynamic viscosity / fluid density

Dynamic Viscosity

Water @ 20°C has a viscosity of 1.00 x 10^{-3} Pa • s or 1.00 Centipoise
Water @ 70°F has a viscosity of 2.04 x 10^{-5} lbf •s/ft²

Kinematic Viscosity

Water @ 20°C has a viscosity of 1.004 x 10^{-6} m² /s or 1.004000 Centistokes
Water @ 70°F has a viscosity of 10.5900 x 10^{-6} ft² /s

Pipe Flow Wizard has a database of viscosities and densities for common fluids.

15.3 Reynolds Numbers

Reynolds numbers (Re) describe the relationship between a fluid's velocity, the internal pipe diameter and the fluid's Kinematic viscosity.

Reynolds number = Fluid velocity x Internal pipe diameter / Kinematic viscosity

Note: Kinematic viscosity (not Dynamic viscosity) must be used to calculate Reynolds numbers. It is generally accepted that the 'changeover' point between laminar flow and turbulent flow, in a circular pipe, occurs when the Reynolds number (Re) is approximately 2100.

i.e. Laminar flow occurs when the Re is less than 2100. Turbulent flow occurs when the Re is greater than 4000. Between the Laminar and Turbulent flow conditions the flow may be neither wholly laminar nor wholly turbulent. In this transition region there is no exact equation to calculate the friction factor and therefore only an approximate friction factor can be used by way of appropriate interpolation.

15.4 Friction Factors

Many formulas have been developed to model the flow of fluids. The Hazen-Williams formula has been a popular method of estimating the head loss in piping systems for many years (particularly prior to the availability of today's modern computers). However, this empirical formula will only give reasonable accuracy if the fluid is water at 60^{o}F or similar.

The Colebrook-White formula may be used with confidence to calculate an accurate friction factor applicable to the turbulent flow of fluids. The Colebrook-White formula is applicable over a whole range of fluid densities and viscosities, provided that the fluid flow is turbulent.

The Pipe Flow Wizard software uses the Colebrook-White friction factor with the Darcy-Weisbach equation when calculating friction loss for non-compressible flow (liquids). The Colebrook-White friction factor is also used with some compressible gas flow equations such as the General Fundamental Flow equation.

15.5 Colebrook-White Formula

The Colebrook-White formula:

$$1/\mathrm{sqrt}(f) = 1.14 - 2\log_{10}[e/D + 9.35/(\mathrm{Re} \times \mathrm{sqrt}(f))]$$

f = friction factor

e = internal roughness of pipe

D = internal diameter of pipe

Re = Reynolds number

Friction factors for turbulent flow calculated by Pipe Flow Wizard are based on the Colebrook-White formula.

The friction factor for Laminar flow is calculated from f = 64/Re

15.6 Friction Losses (Resistance to Flow)

For liquids, the resistance to fluid flow is usually expressed in fluid head. This is the height of a column of fluid which would exert enough pressure on the fluid at the bottom of the column to make the fluid flow.

If the level of the fluid (fluid head) is increased in a supply container, the volume of fluid entering the system from the supply container will increase due to the increase in pressure (force).

15.7 Darcy-Weisbach Formula

For non-compressible fluids (liquids), fluid head resistance can be calculated by using the Darcy-Weisbach formula.

$$h_{fluid} = f\,(L/D) \times (v^2/2g)$$

f = friction factor
L = length of pipe work
D = inner diameter of pipe work
v = velocity of fluid
g = acceleration due to gravity

Fluid head loss calculated by the Pipe Flow Wizard software when using the non-compressible (liquid) calculation engine is based on the Darcy-Weisbach formula.

This formula can be used for compressible (gas) calculations provided that the gas density at the start of the pipe is used to determine the fluid velocity, and provided that the pressure drop in the pipe is less than ten percent of the absolute pressure at the start condition.

For compressible (gas) calculations where the pressure drop is more than ten percent, but less than forty percent of the absolute pressure at the start of the pipe, the equation gives reasonable results provided that the gas density at the average pressure condition in the pipe is used to calculate the average velocity of the gas.

The Pipe Flow Wizard software however, does not allow use of the Darcy-Weisbach equation for compressible gas calculations since it uses the more accurate specialist compressible gas flow equations, which provide more accurate results, and which are not limited to working with pressure drops of up to a certain percentage of the initial start pressure.

15.8 Fitting Losses

The fluid head resistance through various pipe work fittings can be calculated if the 'K' factor of the fitting is known. Many manufacturers of pipe work fittings and valves publish 'K' factors for their products.

15.8.1 ‘K’ Factor Fitting Head Loss Calculation for Liquids

For non-compressible (liquid) systems, fluid head loss through fittings and valves can be calculated from the following equation:

$$h_{fluid} = 'K' \times v^2 / 2g$$

'K' = manufacturer’s published 'K' factor for the fitting
v = velocity of fluid
g = acceleration due to gravity

15.8.2 Equivalent Length Head Loss Calculation for Gases

For compressible gas flow calculations, the Pipe Flow Wizard software converts the ‘K’ factor of the fitting to an equivalent length of pipe, which will result in the same friction loss. This is done automatically during the calculation.

A ‘K’ factor can be converted to an equivalent length of pipe when the diameter of the pipe is known.

Equivalent length = (K factor * Diameter) / Friction factor

The Pipe Flow Wizard software allows fittings to be placed at both the start and the end of the pipe, and with compressible flow, when pressure loss occurs along the pipe, the gas will ‘expand’ (become less dense), hence it’s velocity will increase, to maintain the same mass flow rate.

The ‘K’ factor method for calculating head loss across a fitting requires that the density of the fluid entering the fitting is known, since the result is a head loss that is relative to this density, and with a compressible gas flow calculation, where there are fittings at the start and end of the pipe, the density of the gas is different at these points. In addition, the starting pressure of a gas flow calculation affects the overall

friction loss results (for the same flow rate) and therefore technically if there are fittings at the start of the pipe then the loss through these must be accounted for and the pressure immediately after the fittings would then need to be used as the start pressure for the friction loss calculation.

Using the equivalent length method for compressible gas flow calculations simplifies the problem. Once the overall loss through the pipe has been calculated (including the additional equivalent length for the fittings) then the amount of loss through the fittings at the start and the end of the pipe can be apportioned appropriately to break out the results in to the fittings losses and the pipe friction loss.

15.8.3 Fittings Database

Pipe Flow Wizard has a database of valve and fittings ‘K’ factors and calculation helpers for:

- gradual enlargements
- gradual contractions
- sudden enlargements
- sudden contractions
- rounded entrances
- long pipe bends

In systems where pipe lengths are relatively long, the effect of the fitting losses for bends may be minor (in comparison to the long pipe friction losses) and in these cases, fitting losses are sometimes ignored during initial assessment of the system.

If a partially open valve is part of the design, the effect of the valve should always be considered as the valve loss may be large.

15.9 Compressible Gas Flow Equations

Friction loss for a compressible fluid, such as a gas, needs to account for the change in density, as the gas moves along the pipe and loss of pressure occurs. When using the compressible flow calculation engine Pipe Flow Wizard can be set to use one of the following compressible flow equations:

- General Fundamental Isothermal Flow Equation
- Complete Isothermal Flow Equation
- AGA Isothermal Flow Equation
- Weymouth Isothermal Flow Equation
- Panhandle A Isothermal Flow Equation

- Panhandle B Isothermal Flow Equation
- IGT Isothermal Flow Equation

The formula for each of the above equations is detailed in a separate PDF document named ‘Compressible Flow Equations’. This PDF is available from the ‘Results Verification’ menu inside the Pipe Flow Wizard software.

16 Glossary

Term	Description
Absolute Pressure	Pressure measured with respect to zero pressure.
Atmosphere	A standard atmospheric pressure of 1.01325 bar a or 14.696 psi a.
Centipoise	Absolute viscosity of a fluid expressed in Pa • s x 10^{-3}
Centistokes	Kinematic viscosity of a fluid expressed in m^2/s x 10^{-6}
Colebrook-White equation	An equation used to calculate accurate friction factors from the internal diameter and internal roughness of a pipe and the Reynolds number for the flow conditions.
Darcy-Weisbach equation	An equation used to calculate the frictional head loss due to fluid flow from the friction factor, the length and diameter of the pipe, the velocity of the fluid and the gravitational constant.
Friction Factor	A factor to be used in the Darcy-Weisbach equation. Either calculated from the Colebrook-White equation or ready from the Moody diagram.
Entry Pressure	The pressure at the start of the pipe.
Exit Pressure	The pressure at the end of the pipe.
Fixed Pressure Loss	A static pressure loss which is independent of the flow rate.
K Value	Coefficient of frictional loss through a valve or pipe fitting.
Moody Diagram	A graphical representation of the relationship between Reynolds number, relative roughness and Friction factor.
Pressure Loss	The friction loss due to fluid flow expressed in a relative fluid head or a non-relative unit of pressure.
Reynolds Number	A dimensionless number derived from the fluid velocity, the internal diameter of the pipe and the Kinematic viscosity of the fluid.

Vapor Pressure	The absolute pressure at which a liquid will start to evaporate.
Viscosity	A measure of a fluid’s resistance to flow.