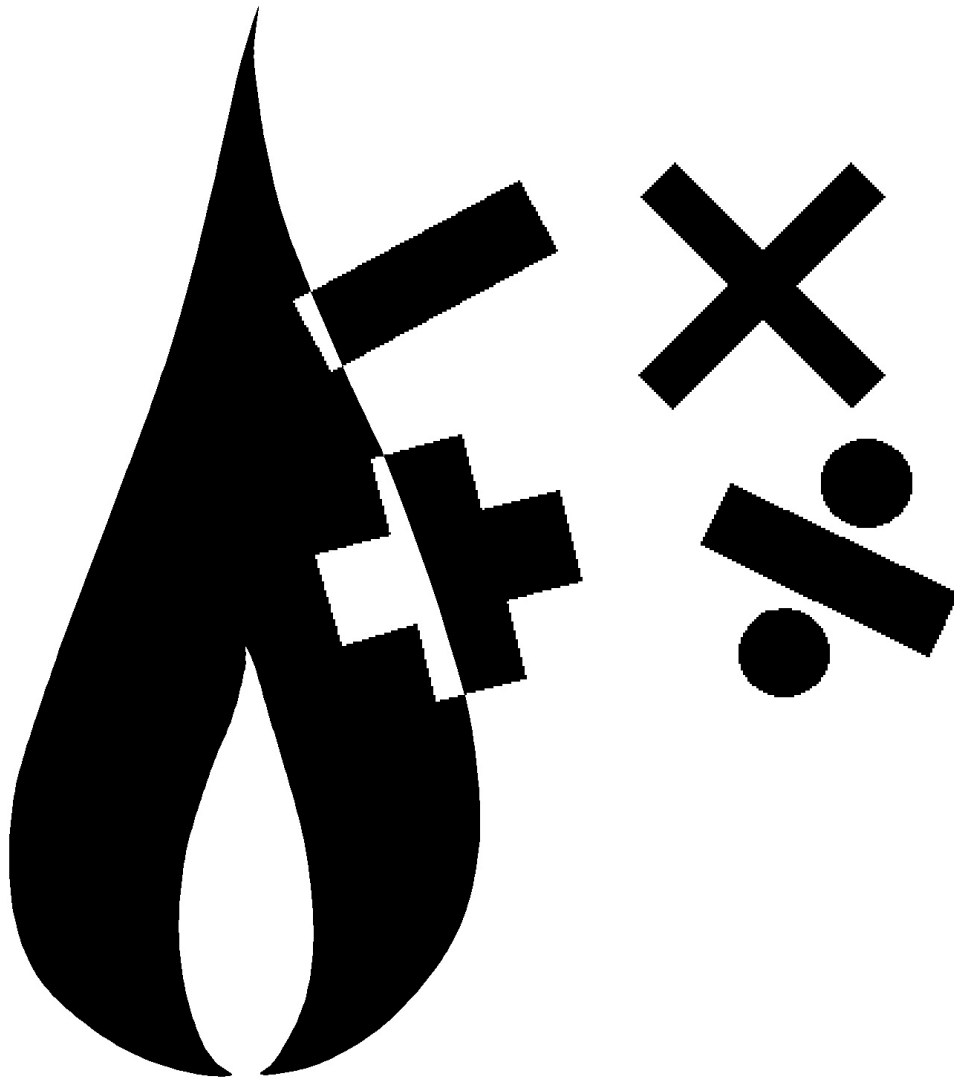


GASCalcTM 5.0

Demonstration Guide



B3PE LLC
419 East Columbia Street
Colorado Springs, Colorado 80907 USA
(719) 578-9391
www.b3pellc.com

Thank you for your interest in our products, and for taking the time to view our demonstration software. We hope that you will be pleased with what you see during the demonstration. We are truly committed to providing products that ensure your success. If you have suggestions which might help improve GASCalc to better meet your needs - *please*, let us know your ideas. Again, thank you for your interest...

A handwritten signature in black ink, appearing to read 'B3' or 'BB', with a stylized flourish.

Bradley B. Bean, PE
Managing Member

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Working the example contained in this guide should give you a good introduction to the software's features and ease of use. If you wish to explore the software further, we suggest reviewing the examples contained in the individual Calculation References.

Getting Help - Contact Us

Hours - Our normal work hours are 8:00 A.M. to 5:00 P.M. Mountain Time, Monday through Friday. However, if you have a problem, please try at any time - we may be in.

By Telephone - (719) 578-9391

By Email - help@b3pe.com

By Website - www.b3pellc.com

Example

The following example will guide you through the general steps involved with performing a GASCalc calculation. Although the example guides you through several pipe flow related calculations, the general steps involved with the calculation can be applied to perform nearly any of the other calculations. Because of the length of this topic, it might be beneficial to print the topic before proceeding with the example.

Note...

In this example, two values are listed where a data value is given. The first value represents the value in **English/US** dimensional units. The second value, enclosed in brackets [], represents the value in Metric units. Use the appropriate values.

For this example, we will start by determining the pressure drop associated with the flow of **10 Mcfh** [250 m3h] through **1000 Feet** [305 Metres] of two-inch plastic pipe. The inlet pressure to the pipe segment is **40 Psi** [2760 mBar]. The average geographic elevation of the line is **300 Feet** [90 Metres] above sea level, and the average gas flowing temperature is **60 Fahrenheit** [15.6 Celsius]. We will neglect the effect of fittings for this first calculation. After we have calculated the pressure drop, we will determine the minimum pipe size or sizes required to maintain a specific outlet pressure. Start by using the following steps to calculate the pressure drop associated with these conditions.

If GASCalc is not running, start it now.



Open The Pipe Flow Calculation Screen

- From the *Pipe* menu list, select the *Pipe Flow* menu item. The Pipe Flow calculation screen will be displayed. Select the *Clear* command button.

Note...

You will notice various data items, dimensional units, and calculated values listed on the screen. Data values are entered by typing the desired value into the associated data field, or for some items like pipe diameter, by selecting an item from the associated drop-down list. Dimensional units are set by selecting the desired item from the associated drop-down list. Several of the data values have a colored label next to them. For example, the labels for the Diameter, Length, Efficiency, Flow Rate, In Pressure, and Out Pressure items are colored red on this calculation screen. These represent the individual data items that can be “unknown” - can be calculated during the calculation. The “unknown” value will be underlined. To change the “unknown” value, click on the associated red label. Only one of the red item labels can be underlined per calculation.

Note...

When multiple images are displayed, the first image displays the calculation results in US Dimensional Units. The second screen image displays the calculation results in Metric Dimensional Units.

Set The Base Conditions

Before performing any pressure or flow related calculations, the base conditions for the calculation must be established. This involves setting the base pressure, temperature, and gas property values. Set the base conditions as follows:

- Select the *Base Conditions* command button on the Pipe Flow calculation screen. The Base Conditions screen will be displayed.
- Set the following data values:

Pressure = **14.73 Psi (Abs)** [1016 mBar (Abs)]

Temperature = **60 Fahrenheit** [15.6 Celsius]

Use Gas Properties File = **us standard.prp** [uk standard.prp]

Atmospheric Pressure Method = **AGA**

Compressibility Method = **None**



- After all the values have been set, select the *Apply* command button to save the changes.

Set The Heat Loss/Gain Data

For this example, we will not be performing any temperature calculations. Ensure that the temperature calculation methods are turned off. To check the settings:

- On the Pipe Flow calculation screen, select the *Heat Loss/Gain Data* tab. Set the following values:

Calculation Method = **None**

Include Joule-Thomson Cooling = **Unselect**

Set The Other Data

- If the *Other Data* tab has a number following the label, it is indicating that fittings or additional pipe segments are attached. If a number is shown, select the *Other Data* tab and select the *Clear* command button to remove the attached fittings or segments.

Enter The Pipe Data

- Return to the *Pipe Data* tab by clicking on the tab heading.
- Indicate that the outlet pressure value is to be calculated by clicking on the red *Out Pressure* label until it is underlined.
- Set the following values:

Pipe Flow Equation = **Institute of Gas Technology - Improved** [Institution of Gas Engineers Recommendation 3 - Medium Pressure]

Diameter = **2P-S11 Inches** [63P-S11 Millimeter]

Length = **1000 Feet** [305 Metres]

Efficiency = **0.95 Decimal**

Flow Rate = **10 Mcfh** [250 m3h]

In Pressure = **40 Psi** [2760 mBar]

In Elevation = **300 Feet** [90 Metres]

Out Elevation = **300 Feet** [90 Metres]

In Temperature = **60 Fahrenheit** [15.6 Celsius]

Out Temperature = **60 Fahrenheit** [15.6 Celsius]

Min/Max Velocity = **Feet/sec** [Metres/sec]

Pipe Data	Other Data	Heat Loss/Gain Data
Pipe Flow Equation... Institute of Gas Technology - Improved		
Segment Data... Diameter: ? 2P-S11 Inches i Length: 1000 Feet Efficiency: 0.95 Decimal Roughness: 0.000060 Inches Flow Rate: 10 Mcfh		End Conditions... In Pressure: 40 Psi Out Pressure: Psi In Elevation: 300 Feet Out Elevation: 300 Feet In Temperature: 60 Fahrenheit Out Temperature: 60 Fahrenheit
Calculated Values... Inside Diameter: 1.943 Inches Pressure Drop: Min / Max Velocity: Feet/sec Compressibility: Line Volume: Ave Pressure:		

Pipe Data	Other Data	Heat Loss/Gain Data
Pipe Flow Equation... Institution of Gas Engineers Recommendation 3 - Medium Pressure		
Segment Data... Diameter: ? 63P-S11 Millimeter i Length: 305 Metres Efficiency: 0.95 Decimal Roughness: 0.000059 Inches Flow Rate: 250 m3h		End Conditions... In Pressure: 2760 mBar Out Pressure: mBar In Elevation: 90 Metres Out Elevation: 90 Metres In Temperature: 15.6 Celsius Out Temperature: 15.6 Celsius
Calculated Values... Inside Diameter: 50.900 Millimeter Pressure Drop: Min / Max Velocity: Metres/sec Compressibility: Line Volume: Ave Pressure:		

Calculate The Outlet Pressure Value & The Pressure Drop

- Select the *Calculate* command button. The results should look similar to one of the following images.

The screenshot shows the 'Pipe Flow...' dialog box with the 'Pipe Data' tab selected. The 'Pipe Flow Equation...' is set to 'Institute of Gas Technology - Improved'. The 'Segment Data...' section includes: Diameter (2P-S11, Inches), Length (1000, Feet), Efficiency (0.95, Decimal), Roughness (0.000060, Inches), and Flow Rate (10, Mcfh). The 'End Conditions...' section includes: In Pressure (40, Psi), Out Pressure (37.02, Psi), In Elevation (300, Feet), Out Elevation (300, Feet), In Temperature (60, Fahrenheit), and Out Temperature (60, Fahrenheit). The 'Calculated Values...' section shows: Inside Diameter (1.943 Inches), Pressure Drop (2.98 Psi), Min / Max Velocity (36.4 / 38.5, Feet/sec), Compressibility (1.000), Line Volume (0.074 Mcf), and Ave Pressure (38.53 Psi). The bottom buttons are: Calculate, Swap Pressures, Base Conditions, Clear, Help, Notes, Cancel, Open, Save, Print, and Close.

Pipe Data		Other Data		Heat Loss/Gain Data	
Pipe Flow Equation...					
Institute of Gas Technology - Improved					
Segment Data...			End Conditions...		
Diameter:	2P-S11	Inches	In Pressure:	40	Psi
Length:	1000	Feet	Out Pressure:	37.02	Psi
Efficiency:	0.95	Decimal	In Elevation:	300	Feet
Roughness:	0.000060	Inches	Out Elevation:	300	Feet
Flow Rate:	10	Mcfh	In Temperature:	60	Fahrenheit
			Out Temperature:	60	Fahrenheit
Calculated Values...					
Inside Diameter:	1.943 Inches		Compressibility:	1.000	
Pressure Drop:	2.98 Psi		Line Volume:	0.074 Mcf	
Min / Max Velocity:	36.4 / 38.5	Feet/sec	Ave Pressure:	38.53 Psi	
Calculate Swap Pressures Base Conditions Clear Help Notes Cancel Open Save Print Close					

Pipe Flow...

Pipe Data | Other Data | Heat Loss/Gain Data

Pipe Flow Equation...
Institution of Gas Engineers Recommendation 3 - Medium Pressure

Segment Data...

Diameter: 63P-S11 | Millimeter | i
Length: 305 | Metres
Efficiency: 0.95 | Decimal
Roughness: 0.000059 | Inches
Flow Rate: 250 | m3h

End Conditions...

In Pressure: 2760 | mBar
Out Pressure: 2622.14 | mBar
In Elevation: 90 | Metres
Out Elevation: 90 | Metres
In Temperature: 15.6 | Celsius
Out Temperature: 15.6 | Celsius

Calculated Values...

Inside Diameter: 50.900 Millimeter | Compressibility: 1.000
Pressure Drop: 137.86 mBar | Line Volume: 2.258 M3
Min / Max Velocity: 9.2 / 9.6 | Metres/sec | Ave Pressure: 2691.50 mBar

Calculate | Swap Pressures | Base Conditions | Clear | Help | Notes
Cancel | Open | Save | Print | Close

Note... The results indicate that the Pressure Drop for these conditions is approximately **3 Psi** [138 mBar] resulting in an Outlet Pressure of about **37 Psi** [2620 mBar]. For illustration purposes, let's say that it is acceptable for the Outlet Pressure to be as low as **35 Psi** [2410 mBar], then let's calculate the pipe size required to produce that value with the other specified conditions remaining the same.

Calculate The Pipe Size

- Indicate that the *Diameter* value is to be calculated (“unknown”) by clicking on the *Diameter* label until it is underlined. Set the *Out Pressure* to **35 Psi** [2410 mBar].

Pipe Data	Other Data	Heat Loss/Gain Data
Pipe Flow Equation... Institute of Gas Technology - Improved		
Segment Data...		End Conditions...
Diameter: ? 2P-S11	Inches	In Pressure: 40 Psi
Length: 1000	Feet	Out Pressure: 35 Psi
Efficiency: 0.95	Decimal	In Elevation: 300 Feet
Roughness: 0.000060	Inches	Out Elevation: 300 Feet
Flow Rate: 10	Mcfh	In Temperature: 60 Fahrenheit
		Out Temperature: 60 Fahrenheit

Pipe Data	Other Data	Heat Loss/Gain Data
Pipe Flow Equation... Institution of Gas Engineers Recommendation 3 - Medium Pressure		
Segment Data...		End Conditions...
Diameter: ? 63P-S11	Millimeter	In Pressure: 2760 mBar
Length: 305	Metres	Out Pressure: 2410 mBar
Efficiency: 0.95	Decimal	In Elevation: 90 Metres
Roughness: 0.000059	Inches	Out Elevation: 90 Metres
Flow Rate: 250	m3h	In Temperature: 15.6 Celsius
		Out Temperature: 15.6 Celsius

Note...

When calculating a diameter value GASCalc will calculate both an exact Inside Diameter value, and will select a combination of pipe sizes that will produce the exact Outlet Pressure value. The pipe size selection requires the User to indicate which sizes and types of pipes that GASCalc can select from. This is done using the *Sizing Group* item on the *Other Data* tab. The Sizing Group represents a group of preselected pipe sizes and types from the Pipe Property Table. The Pipe Property Table lists information about the various pipes available for use in the pipe-related calculations. The values and settings in the Pipe Property Table can be modified by the User by selecting the *Edit Pipe Properties* menu item from the *Pipe* menu list. For this example, we will use the standard settings.

- Select the *Other Data* tab. Set the following values:

Sizing Group = **Group-1** [Group 3]

Allowable Velocity = **55 Feet/sec** [20 Metres/sec]

Note...

- The Group-1 sizing group consists of common-size Medium Density Polyethylene Plastic Pipe.
- For various reasons, sometimes specific design criteria will limit the velocity of the gas in a pipe segment. When calculating a Diameter value, GASCalc initially calculates the size based on the specified inlet and outlet pressure values, it then checks whether the pressure-based size meets the specified allowable velocity criteria. If it does not, the size is then recalculated based on the specified allowable velocity value.

The screenshot shows the 'Other Data' tab in the GASCalc 5.0 software. The 'Sizing Group' is set to 'Group-1' and the 'Allowable Velocity' is set to '55 Feet/sec'. There are buttons for 'Add', 'Delete', 'Insert', and 'Clear' under 'Additional Components...'. The 'Additional Length' is set to 'Feet' and there is an 'Ignore Components' checkbox.

- Return to the *Pipe Data* tab. Select the *Calculate* command button. The results should look similar to one of the following figures.

Note...

- The Diameter value represents the required inside pipe diameter to produce the specified pressure drop (difference in inlet and outlet pressure). The *Selected Pipe Sizes* item represents the sizes within the specified Sizing Group, whose inside diameter is closest to but not less than the calculated inside diameter value. In this case, only one size is shown with a note stating that the next smaller size in the Sizing Group cannot meet the allowable velocity criteria. The note means that the velocity is too high in the next smaller pipe size.
- In some cases, more than one size will be shown for the *Selected Pipe Sizes*. Let's increase the allowable velocity and see if a combination of sizes can be selected.

Pipe Flow...

Pipe Data	Other Data	Heat Loss/Gain Data
Pipe Flow Equation... Institute of Gas Technology - Improved		
Segment Data... Diameter: 1.751 - (Dp Sized) Inches Length: 1000 Feet Efficiency: 0.95 Decimal Roughness: 0.000060 Inches Flow Rate: 10 Mcfh		End Conditions... In Pressure: 40 Psi Out Pressure: 35 Psi In Elevation: 300 Feet Out Elevation: 300 Feet In Temperature: 60 Fahrenheit Out Temperature: 60 Fahrenheit
Calculated Values... Inside Diameter: *Not Found* Compressibility: 1.000 Pressure Drop: 5.00 Psi Line Volume: 0.059 Mcf Min / Max Velocity: 36.4 / 40.1 Feet/sec Ave Pressure: 37.54 Psi Selected Pipe Sizes: 2P-S11 - Could Not Calculate Composite - Velocity Criteria Could Not Be Met By Smaller Size		
Calculate	Swap Pressures	Base Conditions
Clear	Help	Notes
Cancel	Open	Save
Print	Close	

Pipe Flow...

Pipe Data	Other Data	Heat Loss/Gain Data
Pipe Flow Equation... Institution of Gas Engineers Recommendation 3 - Medium Pressure		
Segment Data... Diameter: 42.168 - (Dp Sized) Millimeter Length: 305 Metres Efficiency: 0.95 Decimal Roughness: 0.000059 Inches Flow Rate: 250 m3h		End Conditions... In Pressure: 2760 mBar Out Pressure: 2410 mBar In Elevation: 90 Metres Out Elevation: 90 Metres In Temperature: 15.6 Celsius Out Temperature: 15.6 Celsius
Calculated Values... Inside Diameter: *Not Found* Compressibility: 1.000 Pressure Drop: 350.00 mBar Line Volume: 1.507 M3 Min / Max Velocity: 9.2 / 10.2 Metres/sec Ave Pressure: 2587.84 mBar Selected Pipe Sizes: 63P-S11 - Could Not Calculate Composite - Velocity Criteria Could Not Be Met By Smaller Size		
Calculate	Swap Pressures	Base Conditions
Clear	Help	Notes
Cancel	Open	Save
Print	Close	

Re-Calculate The Pipe Size

- Select the *Other Data* tab. Set the following values:

Allowable Velocity = **130 Feet/sec** [40 Metres/sec]

The screenshot shows the 'Other Data' tab in the GASCalc 5.0 software. The 'Sizing Group' is set to 'Group-1'. The 'Allowable Velocity' is set to '130 Feet/sec'. The 'Use A Single Pipe Size Only' checkbox is unchecked. The 'Additional Length' is set to '0.0 Feet'.

The screenshot shows the 'Other Data' tab in the GASCalc 5.0 software. The 'Sizing Group' is set to 'Group-1'. The 'Allowable Velocity' is set to '130 Feet/sec'. The 'Use A Single Pipe Size Only' checkbox is unchecked. The 'Additional Length' is set to '0.0 Feet'.

- Return to the *Pipe Data* tab. Select the *Calculate* command button. The results should look similar to one of the following figures.

Note...

Notice that the calculated Diameter value is the same as in the previous calculation, however, the *Selected Pipe Sizes* item now shows two pipe sizes. The value shows a combination of pipe sizes and associated lengths which if used would result in the specified outlet pressure for the specified conditions. Notice that the calculated Maximum Velocity value is greater than the previously specified allowable value, which is why the smaller pipe size could not be selected in the previous calculation.

Pipe Flow...

Pipe Data **Other Data** **Heat Loss/Gain Data**

Pipe Flow Equation...
Institute of Gas Technology - Improved

Segment Data...

Diameter: 1.751 - (Dp Sized) Inches
Length: 1000 Feet
Efficiency: 0.95 Decimal
Roughness: 0.000060 Inches
Flow Rate: 10 Mcfh

End Conditions...

In Pressure: 40 Psi
Out Pressure: 35 Psi
In Elevation: 300 Feet
Out Elevation: 300 Feet
In Temperature: 60 Fahrenheit
Out Temperature: 60 Fahrenheit

Calculated Values...

Inside Diameter: *Not Found* Compressibility: 1.000
Pressure Drop: 5.00 Psi Line Volume: 0.059 Mcf
Min / Max Velocity: 36.4 / 64.3 Feet/sec Ave Pressure: 37.54 Psi
Selected Pipe Sizes: 2P-S11 - 693.5 Feet, 1-1/2P-S11 - 306.5 Feet

Calculate Swap Pressures Base Conditions Clear Help Notes
Cancel Open Save Print Close

Pipe Flow...

Pipe Data | Other Data | Heat Loss/Gain Data

Pipe Flow Equation...
Institution of Gas Engineers Recommendation 3 - Medium Pressure

Segment Data...

Diameter: 42.168 - (Dp Sized) Millimeter
Length: 305 Metres
Efficiency: 0.95 Decimal
Roughness: 0.000059 Inches
Flow Rate: 250 m3h

End Conditions...

In Pressure: 2760 mBar
Out Pressure: 2410 mBar
In Elevation: 90 Metres
Out Elevation: 90 Metres
In Temperature: 15.6 Celsius
Out Temperature: 15.6 Celsius

Calculated Values...

Inside Diameter: *Not Found* Compressibility: 1.000
Pressure Drop: 350.00 mBar Line Volume: 1.507 M3
Min / Max Velocity: 9.2 / 39.7 Metres/sec Ave Pressure: 2587.84 mBar
Selected Pipe Sizes: 63P-S11 - 287.3 Metres, 32P-S11 - 17.7 Metres

Calculate | Swap Pressures | Base Conditions | Clear | Help | Notes
Cancel | Open | Save | Print | Close

Conclusion

The last step concludes this example. The entered data can be saved by selecting the *Save* command button. A previously saved calculation can be retrieved by selecting the *Open* command button. The calculation data and results can be printed by selecting the *Print* command button. To exit the calculation screen without saving the changes made during the example as the default data, select the *Cancel* command button. To exit the calculation screen and save the changes made during the example as the default data, select the *Close* command button

The skills used in this example – entering data, setting dimensional units, selecting the unknown item, moving between data tabs, and performing the calculations – can be used to perform nearly any of the other calculation routines.

Additional Example Calculations

To reduce the size of the setup file, not all of the GASCalc documentation may be installed. Additional information and documentation can be downloaded from our website (www.b3pelle.com). The full GASCalc documentation contains an example calculation for each calculation routine. When installed, the documentation can be viewed by selecting the *Help* command button on the associated calculation screen, or by selecting the desired document from the *Calculation Reference* submenu of the *Help* menu list.

