

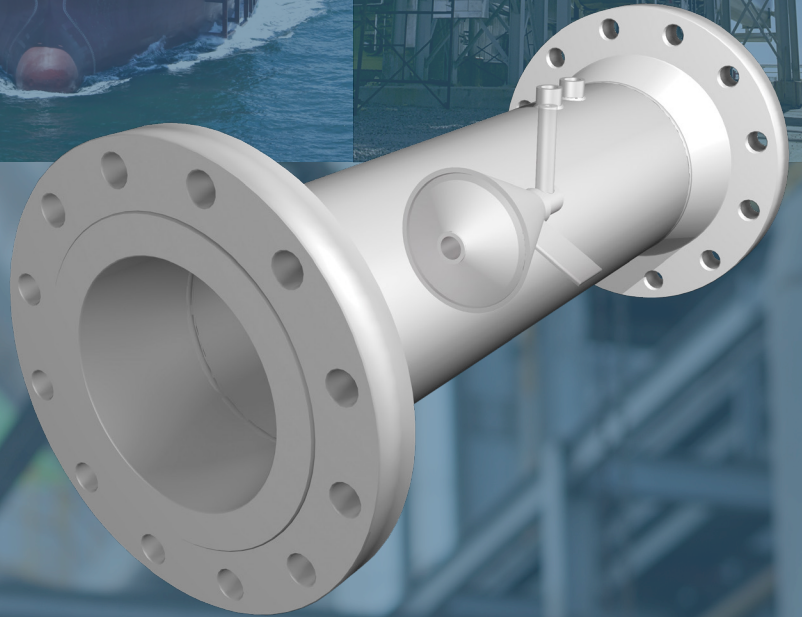


McCROMETER



V-Cone[®]

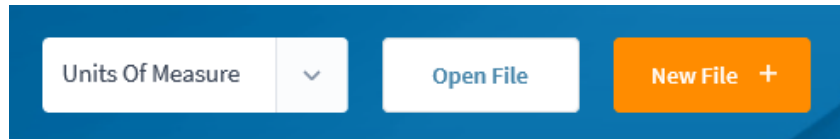
Sizing Tool Instruction Guide



New Sizing Instructions

Starting a Sizing

New meter sizings as well as existing meter sizings can be accessed via the Partnership Portal under “V-Cone Sizing Tool.” The navigation bar at the top of the tool offers three functions.



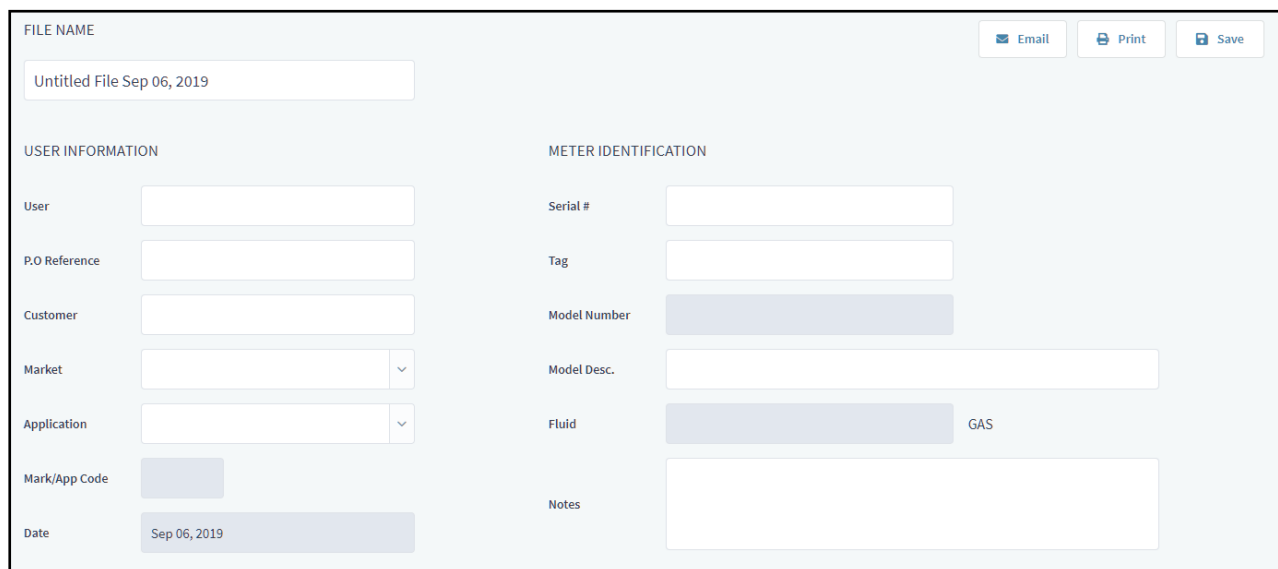
To create a new file, click the orange “New File +” button. The program will erase existing data and bring up a blank form. Remember to save all existing work before proceeding with a new sizing, as all unsaved data will be lost.

If you have an existing sizing file with the extension “.vcone” the program will retrieve saved sizing data. Click the “Open File” button and a dialogue box will appear for you to browse for files by name.

When an existing or new file has been chosen, the “Units of Measure” dropdown menu can be accessed and changed to US (default) or metric.

User and Meter Identification

The project information section of the V-Cone Sizing Tool contains three important components: “File Name,” “User Information,” and “Meter Identification.” The user may now begin creating a file specific to the sizing which can be saved and accessed later as more information is known or changes are required.

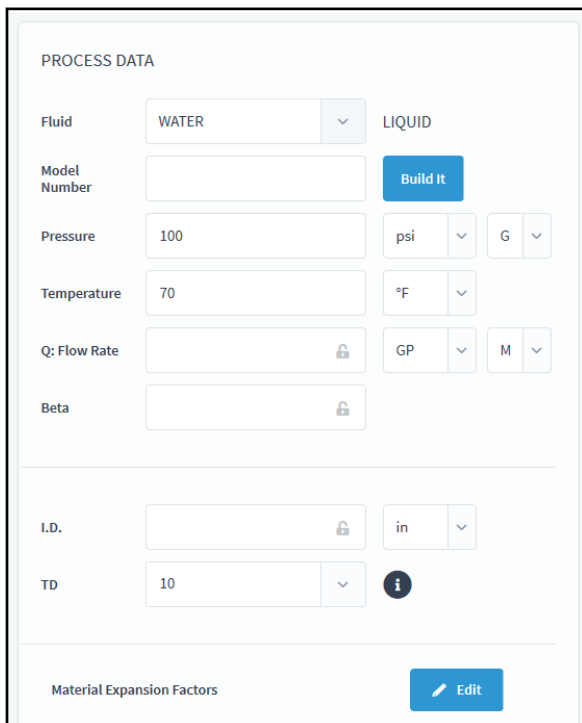
A screenshot of the V-Cone Sizing Tool form. The form is divided into three main sections: 'FILE NAME', 'USER INFORMATION', and 'METER IDENTIFICATION'.
- **FILE NAME:** A text input field containing 'Untitled File Sep 06, 2019'. To the right are three buttons: 'Email', 'Print', and 'Save'.
- **USER INFORMATION:** A column of fields including 'User', 'P.O Reference', 'Customer', 'Market' (dropdown), 'Application' (dropdown), 'Mark/App Code', and 'Date' (pre-filled with 'Sep 06, 2019').
- **METER IDENTIFICATION:** A column of fields including 'Serial #', 'Tag', 'Model Number', 'Model Desc.', 'Fluid' (pre-filled with 'GAS'), and 'Notes'.

Start by entering a name for the file. When saved, this will be the default name the program selects. A distinct file name helps to differentiate meters when working with large quantities of sizing files.

The section under “User Information” should be populated with the information on the end-user. Ensure the identification of the end-user, the maker for the meter, and the specific application are completed.

The section under “Meter Identification” allows the serial number for existing meters to be populated, and if relevant, the tag, model, description, and notes can be added. The notes space can be used to call out special instructions to McCrometer or to convey other useful information to a customer.

The field “Model Number” is locked, as this field is populated through the completion of a separate “Model Number” builder screen (see the [User and Meter Identification](#) section of this guide.)



PROCESS DATA

Fluid: WATER (dropdown) LIQUID

Model Number: [locked] Build It

Pressure: 100 psi (dropdown) G (dropdown)

Temperature: 70 °F (dropdown)

Q: Flow Rate: [locked] GP (dropdown) M (dropdown)

Beta: [locked]

I.D.: [locked] in (dropdown)

TD: 10 (dropdown) i

Material Expansion Factors: Edit

Process Data

The “Process Data” section of the V-Cone Sizing Tool contains the major inputs to the sizing program. These include the process conditions for a line as well as the configurator for the V-Cone Model Number.

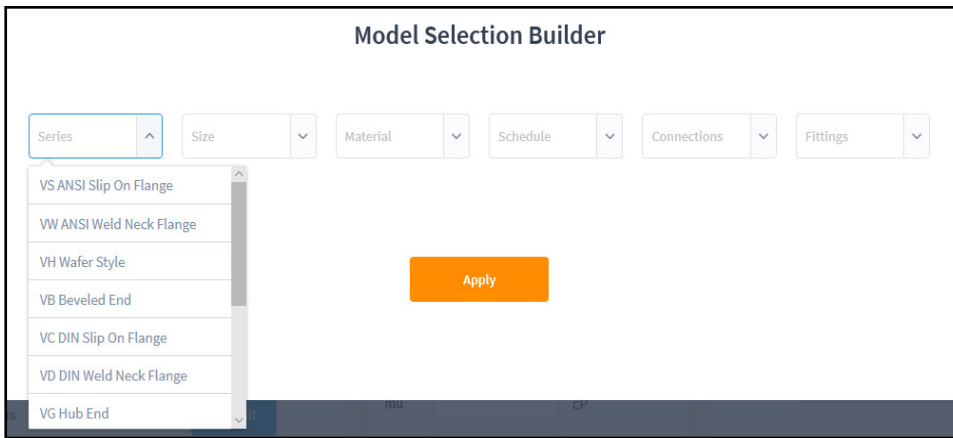
Start by navigating to the “Fluids” dropdown and select the appropriate fluid for the application. The standard properties of all fluids are saved in the sizing program and will automatically populate with a selection. If the desired fluid does not appear in the dropdown menu, the [Fluid Properties](#) section of this guide demonstrates how to edit fluid properties.

The model number is built using either a customer-provided datasheet or information gathered during communication with the end-user. For additional information on the model numbers, please see the [V-Cone Configuration Sheet \(lit # 30122-01\)](#), which is included on the V-Cone Sizing Tool support page of the McCrometer Partnership Portal.

At a minimum, the customer must provide:

- Line size
- Line schedule
- Desired material
- End connection type
- Flange class
- Tap configuration

In the second entry field, the user may enter a full model number or click the “Build It” button. This prompts a dialogue box to assist in the creation of building a model number.



Using the information from “Meter Identification,” the drop-down options in the “Model Selection builder” allow the user to assign the meter attributes and build the model number. Once all fields are complete, select “Apply” to add the model number to the main sizing tool form.

Next, the user will be promoted to “Set ID to Match Model?” Select “OK,” which will allow the program to automatically populate the “Meter ID” section based on the pipe schedule selection in relation to standard pipe sizes.

Enter the three process parameters provided by the customer: pressure, temperature, and flow. Then, change unit selections in the drop-down menus based on customer’s choices. Pressure and temperature must be based on operating conditions, NOT design conditions. Flow rate must be full scale flow rate (i.e. the absolute maximum flow the meter will measure).

Select a beta ratio to generate a Differential Pressure (Dp) based on the meter’s process conditions. Beta ratio selections are available between 0.45 and 0.85. A beta ratio of 0.45 yields the highest amount of Dp based on process conditions. McCrometer’s recommendation if the customer has not specified a maximum Dp is to choose a beta ratio so that the maximum Dp is around 100”WC, or as close as possible.

Note: for advanced users, the fields of “Q Flow Rate,” “DP,” “Beta,” and “I.D.” have a lock symbol next to them. Whichever symbol is highlighted in yellow indicates that the program solved for that variable. The calculated value can be changed by clicking on the grey lock button in another cell. The default calculated value is the Dp.

Turndown is the ratio of the maximum and minimum flow rates and should be selected based on the required minimum flow. A table of the selected turndown will automatically populate based on the selection. The turndown table is reviewed in the [Sizing Summary](#) section of this guide.

The default turndown is 10:1. To determine the proper turndown, divide the maximum flow by the minimum flow. The Dp at the low end of the turndown must be no less than 0.1” WC (≈ 0.249 mbar). Anything lower and the signal will be unreadable by the Dp transmitter.

The Material Expansion Factors offer an “Edit” button to select the appropriate options based on the material selection and temperature. Though changes may be minimal, they could be enough to alter Dp readings by up to 1%.

Material Expansion Factors					
	Range	Factor		Range	Factor
<input checked="" type="radio"/> Plain CS	-300 - 70	4.70E-06	<input type="radio"/> K-Monel	-	7.40E-06
<input type="radio"/> S304	-300 - 70	7.40E-06	<input type="radio"/> Titanium	-	4.70E-06
<input type="radio"/> S316	-300 - 70	7.10E-06	<input type="radio"/> Tantalum	-	3.60E-06
<input type="radio"/> Plain CS	70 - 600	6.70E-06	<input type="radio"/> Duplex 2205	70 - 200	7.50E-06
<input type="radio"/> S304	70 - 600	9.50E-06	<input type="radio"/> Duplex 2205	200 - 600	7.80E-06
<input type="radio"/> S316	70 - 600	9.60E-06	<input type="radio"/> 2-1/4Cr, 1Mo	70 - 200	6.70E-06
<input type="radio"/> Hastelloy C	32 - 212	6.30E-06	<input type="radio"/> 2-1/4Cr, 1Mo	200 - 600	7.10E-06
<input type="radio"/> Inconel	-	6.70E-06			

units of measure: 1E-06/°F

Fluid Properties

The Fluid Properties section of the V-Cone Sizing Tool displays the physical properties of the selected fluid. The program auto-populates most of the fluids based on the data of standard configurations.

Depending on the industry, the callouts for the listed variables may vary.

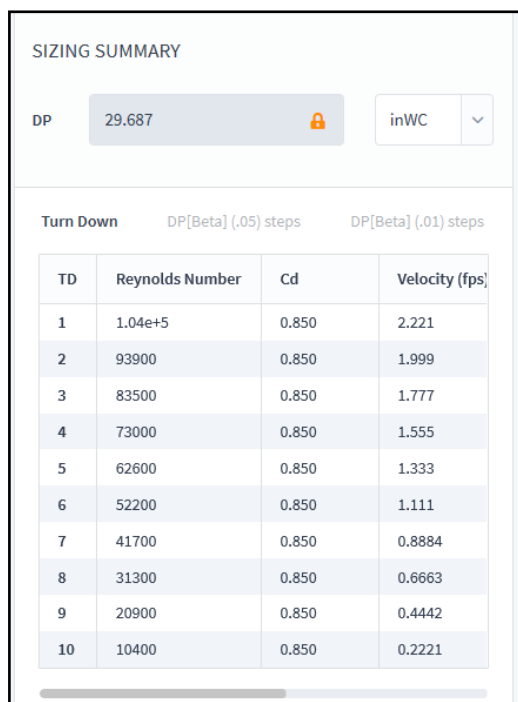
All fluids are slightly different. The preprogrammed data for each fluid may not match the specific properties mentioned in the datasheet. It is the customer's responsibility to call out any differences from these base fluid properties.

To change any of the values listed, delete what is in the cell and add the desired value. If units are noted, ensure the units are changed to match those of the datasheet.

After double-checking if the fluid properties and the process conditions are correct, the program will display a summary of the calculation data based on inputs.

Program Calculated Coefficients	
Abbreviation	Variable
Re	Fullscale Reynolds Number
Y	Gas Expansion Factor
Fa	Flow Coefficient compensated by Material Expansion Factors
Tv	Vapor Temperature
Pv	Vapor Pressure
PPL	Permanent Pressure Loss
V	Velocity
Cone OD	Cone Outside Diameter

Fluid Property Abbreviations	
Abbreviation	Variable
Pb	Base Pressure
Tb	Base Temperature
Patm	Atmospheric Pressure
rho	Density
Gf	Specific Gravity
Z	Compressibility
Zb	Base Compressibility
k	Ratio of Specific Heats
Cp	Specific Heat at Constant Pressure
mw	Molecular Weight
Pc	Critical Pressure
Tc	Critical Temperature
mu	Viscosity
aPE D	Material Expansion Factor for the Pipeline
aPEd	Material Expansion Factor for the Cone
Cd	Meter Flow Coefficient



TD	Reynolds Number	Cd	Velocity (fps)
1	1.04e+5	0.850	2.221
2	93900	0.850	1.999
3	83500	0.850	1.777
4	73000	0.850	1.555
5	62600	0.850	1.333
6	52200	0.850	1.111
7	41700	0.850	0.8884
8	31300	0.850	0.6663
9	20900	0.850	0.4442
10	10400	0.850	0.2221

The result of the calculation is the Dp. The Dp shown is the maximum Dp for the maximum flow conditions. The "Sizing Summary" to the left displays a lock key similar to that described in the [User and Meter Identification](#) section, where the program default is to solve for this Dp value. This is noted by the yellow key icon. Next to this key are the units of measure for the Dp. The standard unit is in "inWC" in imperial units and "mbar" in metric units. Changes to this unit can be made using the dropdown menu to the right of the value.

Below Dp are three tabs: "Turn Down," "DP[Beta](.05) steps," and "DP[Beta](.01) steps."

Turn Down: This table displays flow values and their corresponding Dp values based on the number of turndown steps that were selected in the Meter Identification section. This is where the user will be able to check that the full range of flows is covered. Reminder: make sure that the minimum Dp at the low end of the turndown does not drop below 0.1"WC.

DP[Beta] (.05) steps, and DP[Beta] (.01) steps: These tables help the user choose a beta ratio when the maximum Dp described in Section 5a is undesirable. The table for (.05) steps will show a layout of Dp between 0.45 and 0.80 of the different maximum Dp options. Should the user require a finer look at the intervals, an additional table with steps of 0.01 provides higher resolution Dp options.

Warnings

There are multiple errors which can occur throughout the process of creating meter sizings. These errors are to alert the user to irregular conditions within the sizing that require attention or the sizing may fail. Possible errors and resolutions are detailed below.

Note: Particularly where the line pressure is low to begin with, the user should always check that the permanent pressure loss (PPL) is within acceptable limits. If a requirement for permanent pressure loss is not met, the user can alter the beta ratio to adjust the PPL.

Low Y Factor: The Y factor is less than 0.96. The application may be acceptable if the PPL is in line with the customer's expectations. This warning can be ignored if PPL is acceptable.

Low Dp: The minimum Dp is ≤ 0.1 inWC (0.249 mbar). This covers the full selected turndown range. The beta ratio must be decreased to maintain a measurable reading.

Low Re: The minimum Re is ≤ 8000 . While the application may be acceptable, uncalibrated meter accuracy drops to between 10% - 15% for all such values. Maintaining accuracy at low flows requires an oil calibration. The lower limit for oil calibrations is dependent on the individual situation. Please consult the factory for further assistance.

Gas at P, T: The fluid may be in a gaseous state at the pressure and temperature provided. The customer must check the Pv value. If the user's fluid is meant to be a liquid, verify that the process conditions are correct. If this error is still present and the conditions are correct, please consult the factory for further assistance.

Liquid at P, T: The fluid may be in a liquid state at the pressure and temperature given. The customer will need to check the Pv value. If the user's fluid is meant to be a gas, verify that the process conditions are correct. If this error is still present and the conditions are correct, please consult the factory for further assistance.

Cavitation: Warning will display as "vapor pressure: DP > psia - Pv". Potential fix is to decrease the full-scale Dp.

High Stress: Error Message will state "Von Mises stress > #." The # listed in the statement is the maximum allowable stress of the specific application. Potential fix is to decrease cone size and/or increase line size.

Troubleshooting

The below four scenarios describe possible scenarios in which the user might have trouble completing a meter sizing. Each of these scenarios can be resolved by working through the solutions presented. If these solutions do not resolve the issue, please consult the factory for further assistance.

Problem: Density cannot be calculated or was not entered. Note: Density should not be overridden for gas applications.

Solution: See support engineer for assistance.

Problem: The flowrate entered causes the Dp calculation to be so high that the Dp calculation fails.

Solution: Lower the flowrate or increase the line size.

Problem: The flowrate unit of measure is inappropriate for the application.

Solution: See support engineer for assistance.

Problem: The density calculation may fail due to the entered operating temperature.

Solution: See support engineer for assistance.