User guide OI/Genie–EN

Genie II – Sizing & Selection Software
Wedge and Integral Orifice Flow Meters

Power and productivity
for a better world™

The Company

We are an established world force in the design and manufacture of instrumentation for industrial process control, flow measurement, gas and liquid analysis and environmental applications.

As a part of ABB, a world leader in process automation technology, we offer customers application expertise, service and support worldwide.

We are committed to teamwork, high quality manufacturing, advanced technology and unrivalled service and support.

The quality, accuracy and performance of the Company's products result from over 100 years experience, combined with a continuous program of innovative design and development to incorporate the latest technology.

EN ISO 9001:2000

Cert. No. Q 05907

EN 29001 (ISO 9001)

Lenno, Italy – Cert. No. 9/90A

Stonehouse, U.K.

0255

Electrical Safety

This equipment complies with the requirements of CEI/IEC 61010-1:2001-2 'Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use'. If the equipment is used in a manner NOT specified by the Company, the protection provided by the equipment may be impaired.

Symbols

One or more of the following symbols may appear on the equipment labelling:

	Warning – Refer to the manual for instructions
	Caution – Risk of electric shock
	Protective earth (ground) terminal
	Earth (ground) terminal

	Direct current supply only
	Alternating current supply only
	Both direct and alternating current supply
	The equipment is protected through double insulation

Information in this manual is intended only to assist our customers in the efficient operation of our equipment. Use of this manual for any other purpose is specifically prohibited and its contents are not to be reproduced in full or part without prior approval of the Technical Publications Department.

Health and Safety

To ensure that our products are safe and without risk to health, the following points must be noted:

1. The relevant sections of these instructions must be read carefully before proceeding.
2. Warning labels on containers and packages must be observed.
3. Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given.
4. Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and/or temperature.
5. Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
6. When disposing of chemicals ensure that no two chemicals are mixed.

Safety advice concerning the use of the equipment described in this manual or any relevant hazard data sheets (where applicable) may be obtained from the Company address on the back cover, together with servicing and spares information.

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1 Installation

It is always best to close any open Window applications or virus utilities before installing any Windows Program application. Additionally, system privileges must be provided for loading components into c:/windows/system directories.

Any previous version of the ABB GENIE II Program should be removed. This is done in the Windows Control Panel, Add/Remove Programs.

1. Download the ABB GENIE II Program.
2. In the Windows Start Button on the Microsoft Task Bar, go to Settings>Control Panel>, then double-click on Add/Remove Programs and follow the on screen instructions for “Add New Programs”. (For versions downloaded to your PC, go to the directory into which the Program was downloaded).
3. Click on the button for “Add a Program from Floppy Disk or CD-ROM ’ and follow the on-screen instructions

The Setup Program should start by ‘Copying initialization files.’ If you are a first time user, the Setup may request to shutdown and restart your computer. This is a standard Microsoft setup and allows for proper registration. Click OK and allow the system to reboot. Any error during the install process should be reported to your IS administrator.

The Setup Program will check for sufficient disk space. If there is insufficient space, Setup will stop the installation process and advise you to clear space before proceeding.

1.1 Setup

To start the ABB GENIE II Program, click the Start button on the Microsoft Task Bar, then Programs>ABB Program Suite.

To have easy access to the ABB GENIE II Program, create a desktop icon. Once the desktop icon is created, all you need to do is double-click the icon.

System Requirements

Computer:	Pentium or better
Memory:	12 MB RAM
Minimum Disk Space:	25 MB
Operating System:	MS Windows *
Networking:	Capabilities Available
Other Software:	MS Office
Display resolution	800 x 600 pixels
Display color	256 color required, 32 bit preferred

*ABB Genie software has been demonstrated to execute successfully on Windows 7 operating systems however certain system configurations, firewall setups or other IT limiting applications may cause the program to crash, freeze or not run at all. If this is encountered is it recommended to run the software in the Windows XP mode.

2 Introduction

This software is an essential tool to assist in the selection and application of ABB flow meters and to support troubleshooting issues. Many features have been incorporated to provide access to standard physical properties, generic and intricate process engineering conversions and “what if” decision making with point and click simplicity.

Design specification changes are easily entered and instantly calculated. Entries that do not meet specific meter design criteria are color-coded, with results blocked in yellow - indicating caution – or blocked in red – indicating that a specification has been violated.

Advanced users may take advantage of entering specific data relating to tap elevation, pipe roughness and process variables to further define the sizing criteria.

Project information and other comments may be entered directly from the main sizing screen for future retrieval and printing.

The Results show meter calculations, design details, pressure drop factors, power consumption and flow element hourly and yearly operating costs, and more. References for the calculation basis can be extracted from the physical property and other standard data tables.

Results can be saved directly to Word and Excel formats, and e-mailed to end users, purchasing contacts, or co-workers.

Note. This program is intended to be used as a tool for the selection and sizing of ABB flow meters based on application conditions. All results are estimates using either empirical data or industry accepted equations and may not reflect exact results when in actual use. ABB Automation Inc. provides this program “as is” with no warranty of any kind. The user assumes full responsibility for its application and use of data and results.

2.1 Features

Text Toolbar: File, Edit, View, Start, Results, Window, Help

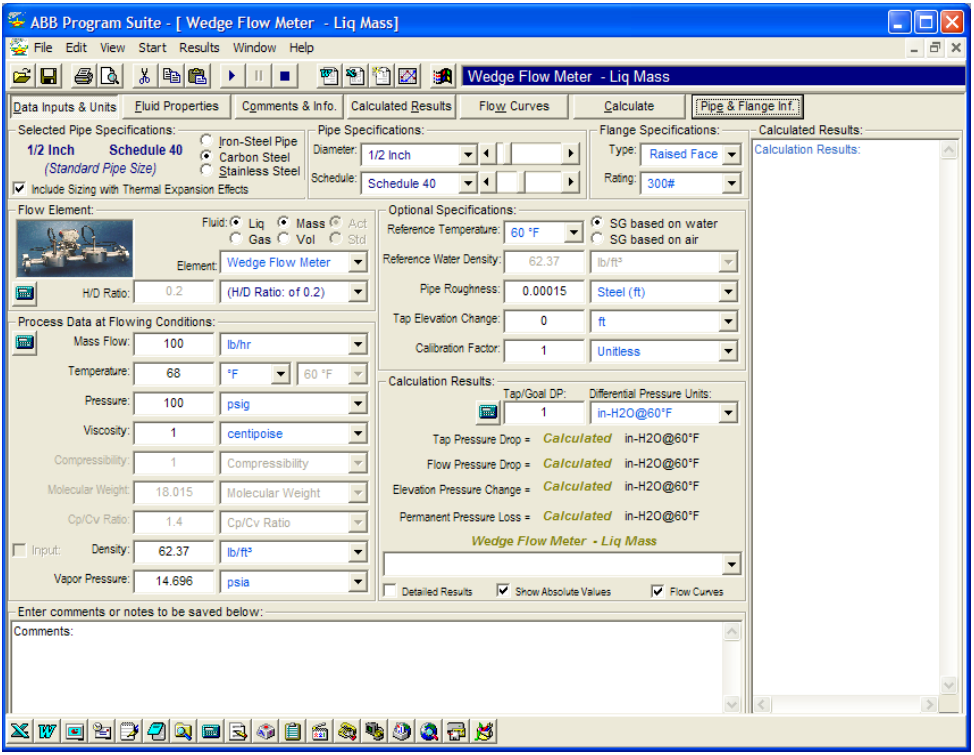
Icon Toolbar: Open, Save, Print, Print Preview, Cut, Copy, Paste, Start, Pause, Stop, Word Results, Excel Results, Quick View, Graph Results, and Windows Toolbar.

The Toolbar for the Initial Default Screen includes the following buttons:

- Data Inputs & Units — Enter all required data and appropriate units.
- Fluid Properties — Sets all fluid properties based on selected fluid.
- Standard Conditions — Enter both standard and flowing conditions.
- Comments & Info — Enter any information and comments to be saved.
- Calculated Results — Calculate all results and displays in text format.
- Graphical Results — Calculate all results and displays graphically.
- Calculate — Calculate all sizing results.

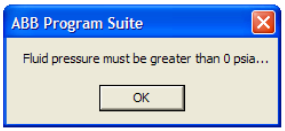
There are two blank areas on the Initial Default Screen.

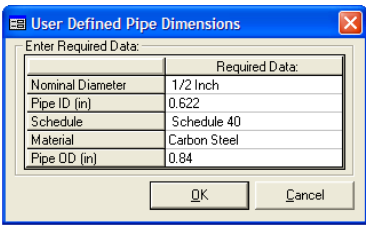
- The area at the bottom provides any area to enter any calculations or comments to be saved.
- The area at the right will provide the results of the selections after calculations are completed. The slide bars at the right hand side and bottom assist in viewing while in this initial screen.



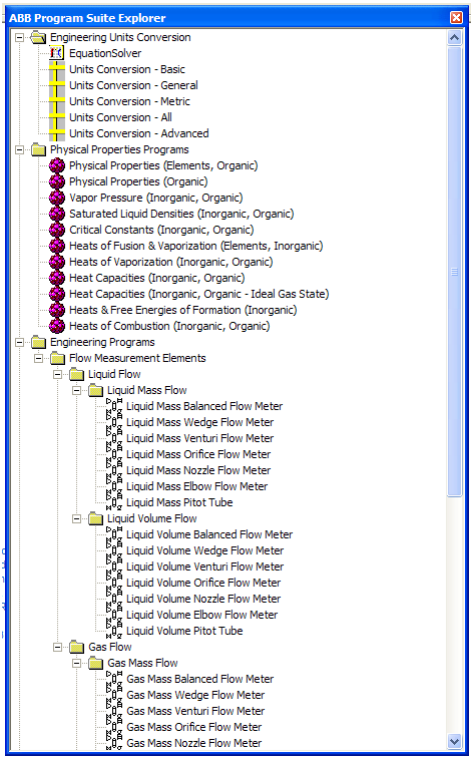
To start the program, click FILE in the upper left toolbar. Next click on NEW. This clears any data stored in the program registers from the previous session.

When selections are made which are outside of specification parameters, prompts appear to assist you. Two examples of such prompts are shown below :





The Windows Toolbar provides access to the ABB Program Suite Explorer and the following programs.



2.2 Data Inputs & Units Screen

The Data Inputs & Units screen is the default opening screen and sizing calculations may be performed with no further window selections, providing the process data is in actual conditions. Described below are the various sections of the opening screen.

Selected Pipe Specifications

- Select Nominal Diameter between ½ inch and 36 inch by utilizing the drop down menu, or the slide bar to the right of the drop down menu.
- Select Pipe Schedule by utilizing the drop down menu or the slide bar.
- Select the material from Iron-Steel, Carbon or Stainless Steel.

Note. Once selected, the chosen Pipe Specifications are highlighted at the left. If the text in this area is blue, the pipe sizing exists. If the text is red, it is a non-standard pipe size. For Wedge products, not all pipe sizes/schedules may be offered within the standard product line and may require a factory quotation.

Flow Element

- Fluid – select the fluid phase (Liquid or Gas) and flow type (Mass or Volume units).

Note. Changes made in this section are reflected in the area below - "Process Data at Flowing Conditions".

Element – Select the type of element to be sized, using the drop down box. This selection changes the description and content of the meter characteristic selection below.

The meter types available (and the corresponding characteristic) are:

Wedge Flow Meter	(H/D ratio or input Kd2)
Venturi Flow Meter	(Beta ratio or input bore diameter)
Orifice Flow Meter	(Beta ratio or input bore diameter)
Nozzle Flow Meter	(Beta ratio or input bore diameter)
Elbow Flow Meter	(Radius of curvature)
Pitot Tube.	(Velocity Head factor)

Note.

1. The Pitot Tube option is historical and does not allow correct sizing of either a Torbar or a PitoMaster.
2. The sizing of Venturi Tubes, Nozzles, etc is for guidance only and should only be used to establish that a particular DP value is viable for the entered flow data, not for establishing meter geometry or for calculating an accurate meter bore.

Example: If the selection is changed from a Wedge to a Nozzle, the box below changes from a H/D Ratio selection to a Radius of Curvature data entry. Select and highlight the default number of 1 and enter the correct radius value. In the drop down box to the right, select the unit of measurement appropriate to the radius value.

Note. based on the selection of, for example, Liquid or Gas, certain selections will be disabled and cannot be changed, selected or highlighted.

Process Data input

Process data may be entered in one of the following ways:

Actual Conditions

1. Process data for actual conditions may be entered directly on the opening default input screen. Items highlighted in blue are the required inputs.
2. If required, select the Fluid Properties button, enter pressure, temperature and density, then select one of the fluid properties sections at the bottom of the window bottom and find the fluid being measured. Calculations for MW, vapor pressure etc are calculated and brought forward to the calculation screen.

The Process Data at Flowing Conditions can be selected, highlighted and new inputs entered. Drop down boxes contain additional options.

Note. If selection areas are disabled, they are not required for the current selection.

Parameters in the area "Process Data at Flowing conditions" :

- Volumetric Flow Rate
- Temperature
- Pressure
- Viscosity
- Compressibility
- Molecular Weight
- Cp/Cv Ratio
- Density
- Vapor Pressure

Parameters in the area "Optional Specifications" are as follows. If the conditions can be selected and highlighted, new inputs can be entered. Drop down boxes contain additional options.

Note. If selection areas are disabled, they are not required for the current selection.

- Reference Temperature (used for SG calculation)
- Reference Density
- Pipe Roughness
- Tap Elevation Change – used when considering a vertical installation
- Calibration Factor – changing the calibration factor (to any value other than 1) changes the default meter factor. Such changes should only be made by factory personnel.

Parameters in the area *Calculation Results* are as follows:

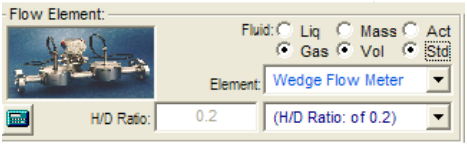
- Select *Differential Pressure* Units – the default is "in-H_20 @60F"
  All the following parameters will then be calculated in the selected units
- Tap Pressure Drop
- Flow Pressure Drop
- Elevation Pressure Drop
- Permanent Pressure Loss

Below these results, a drop box is available to select a program variable or constant and monitor the value based on program input or changes.

Calculated Results – this area to the right defaults to a short form version of the results of the calculation, updated as appropriate whenever the Start button (an icon on the menu bar) or the Calculate button are clicked. This displays the minimum level of data results for sizing. A long form report can be generated by clicking the box next to *Detailed Results* and clicking once more on Start or Calculate . This option can be deselected by clicking again.

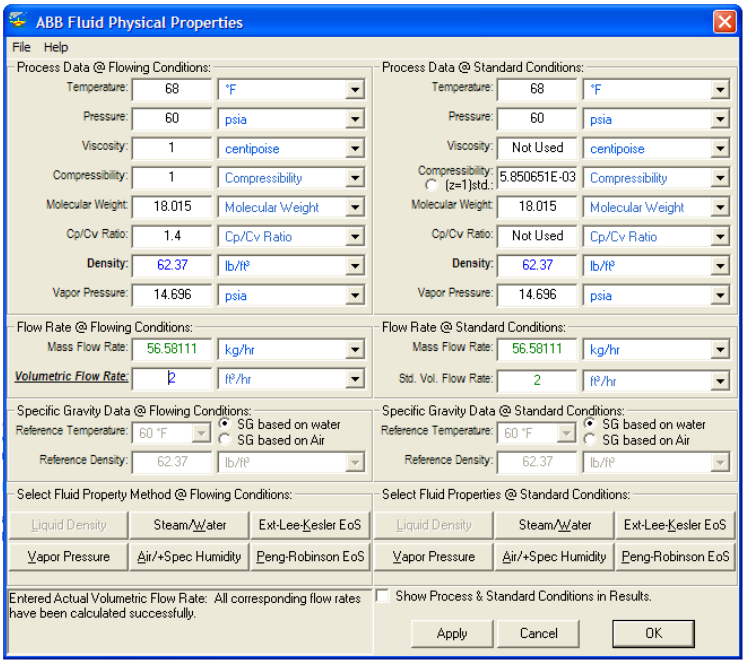
Standard Conditions

It is important to understand that when measuring gases at standard volume conditions (i.e.SCFH), it is necessary to to select Std volume in the Flow Element fluid selection for proper calculation.



The reason for this is that the program internally performs calculations based on converted mass flow rates and will return volumetric rates at both standard and flowing conditions in the results page.

Additionally process data at both standard and flowing conditions may be entered under the fluid properties page for conversion from standard to actual conditions. Click on the *Fluid Properties* button which will display the following screen:-

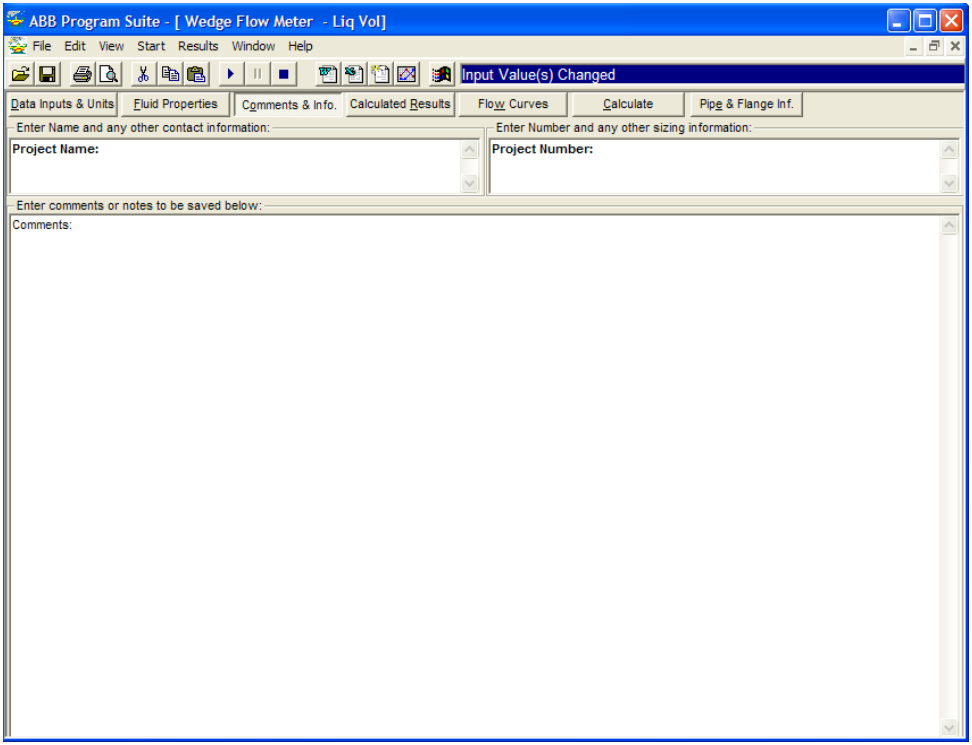


Follow steps similar to those described above for actual conditions, but initially enter data for the fluid at both standard (eg STP, NTP, etc) and flowing (Actual) conditions. The pressure, temperature and density at standard conditions should be entered on the right half of the screen. Enter the flowing (Actual) pressure, temperature and density on the left side of the screen.

Data may be imported from the *Fluid Properties* buttons as before, but on this occasion for both standard and flowing conditions. Enter the flow rate at standard conditions and click *Apply*. The program will calculate mass and actual volumetric rate under the flowing conditions. As before clicking on *Apply* and *OK* will import the data to the main screen for final calculations.

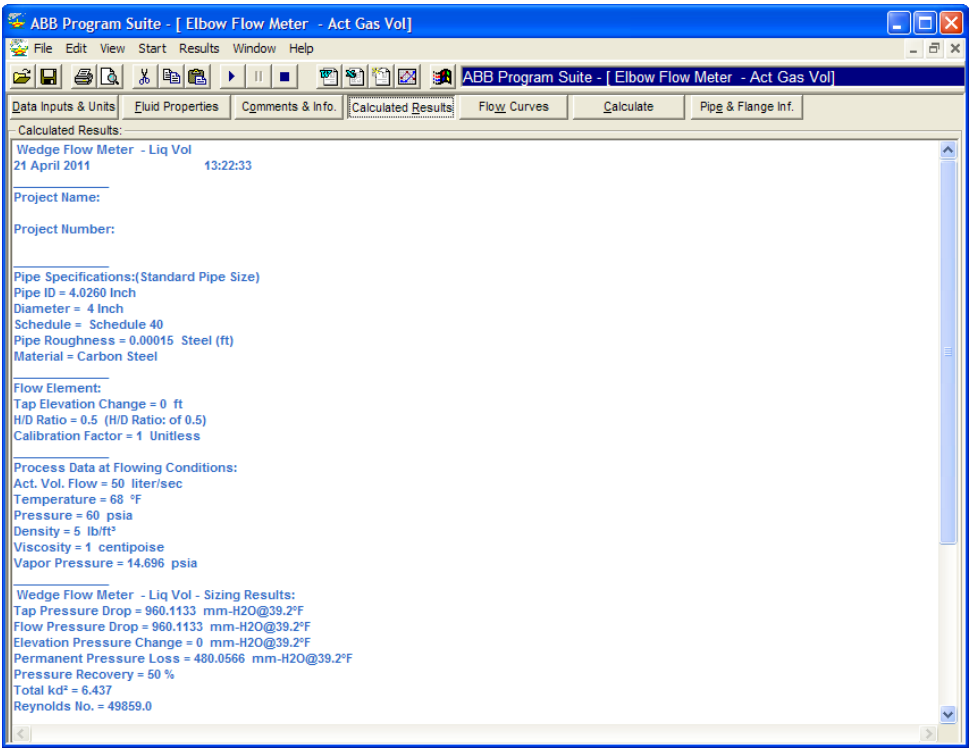
Comments & Information Screen

Clicking on the *Comments and Info*. Button displays the following screen, which provides an easy workstation to enter information and comments to be saved with the calculation. Information can be entered directly from the keyboard or copied and pasted from another area or application.



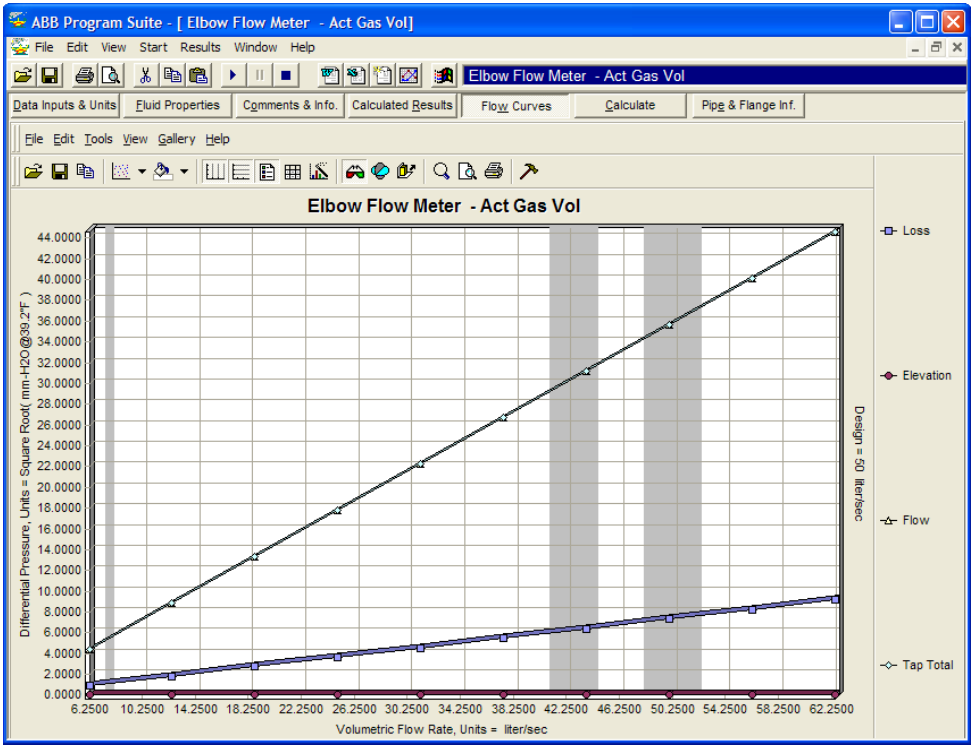
Calculated Results

Clicking on the *Calculated Results* button displays this screen which provides all the calculated results, displaying them in text format.



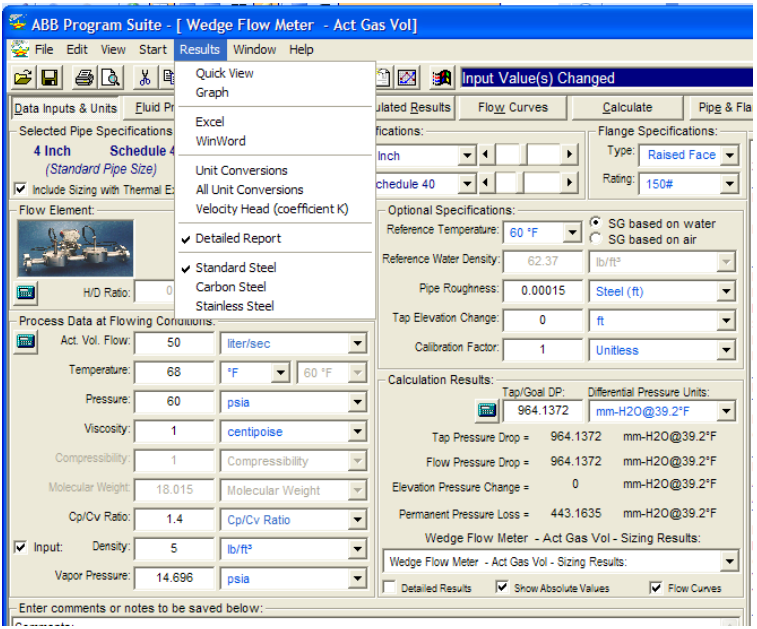
Flow Curves

Clicking on the Flow Curves button displays this screen which displays the results graphically.



Results

The ABB GENIE II program can display results within certain Microsoft products, including Word & Excel. From the menu bar select Results, followed by the format required.



The Microsoft application will then open and be populated with the results. Samples of the text and graphical sheets for Word are shown below. These can be generated into a final report, logged for future reference, or e-mailed to project personnel. Results may be generated in a short or long form.

ABB Program Suite: Wedge Flow Meter - Act Gas Vol Flow

ABB Program Suite	Calculation Results
Wedge Flow Meter - Act Gas Vol	
21 April 2011	14:35:42
Project Name:	
Project Number:	
Pipe Specifications: (Standard Pipe Size)	
Pipe ID	4.0260 Inch
Diameter	4 Inch
Schedule	Schedule 40
Pipe Roughness	0.00015 Steel (ft)
Material	Carbon Steel
Flow Element:	
Tap Elevation Change	0 ft
H/D Ratio	0.5 (H/D Ratio of 0.5)
Calibration Factor	1 Unitless
Process Data at Flowing Conditions:	
Act. Vol. Flow	50 Barrsec
Actual Gas Volume Flow	@Flowing Conditions
Temperature	68 °F
Pressure	60 psia
Density	5 lb/ft³
Cp/Cv Ratio	1.4 Cp/Cv Ratio
Viscosity	1 centipoise
Vapor Pressure	14.696 psia
Wedge Flow Meter - Act Gas Vol - Sizing Results:	
Tap Pressure Drop	964.1372 mm-H2O@39.2°F
Flow Pressure Drop	964.1372 mm-H2O@39.2°F
Elevation Pressure Change	0 mm-H2O@39.2°F
Permanent Pressure Loss	443.1635 mm-H2O@39.2°F
Pressure Recovery	54.03522 %
Total Kd*	6.437
Reynolds No.	49859.0
This program is intended as an engineering tool to aid in the selection of ABB Products.	
ABB Instrumentation provides this package "as is", without warranty of any kind.	
The user or client assumes full responsibility for it's application and integrity of the program output.	
Meter designs below 2 inch-H2O or above 400 in ch-H2O are not recommended.	
Based on ISO, ISA, API, & SME and AGA standard 4. Wedge derived from AGA Rep #3, Part 1.	
This program do es not include the complete product offering available from ABB Instrumentation.	
For purchase of ABB products, please contact your sales representative.	
Results Generated On:	
Date	21/04/2011
Time	14:35:42

ABB Program Suite Graphics: Wedge Flow Meter - Act Gas Vol Flow versus Tap DP

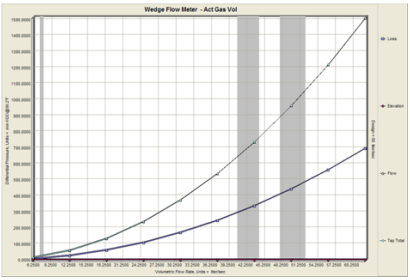
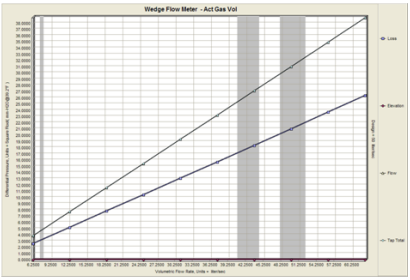


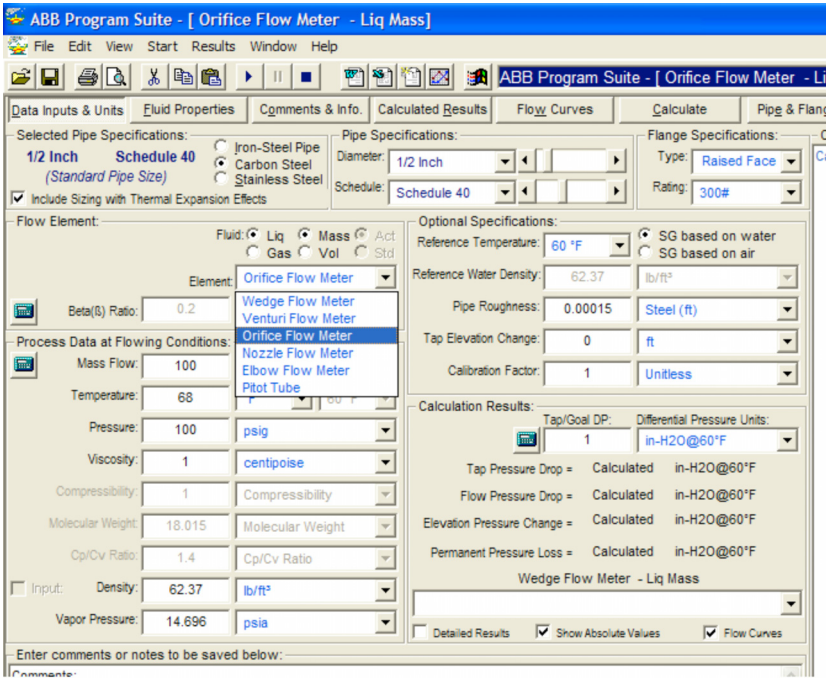
ABB Program Suite Graphics: Wedge Flow Meter - Act Gas Vol Flow Curve



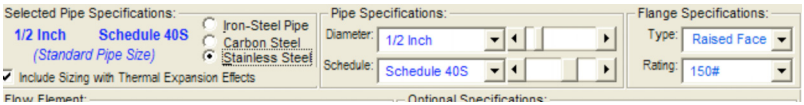
2.3 Sizing Integral Orifice meters (1330L, FPD510 IOMaster)

The following procedure describes the best way to select the most appropriate plate for an integral orifice meter such as the 130L or FPD510 IOMaster, and calculate the resultant DP generated.

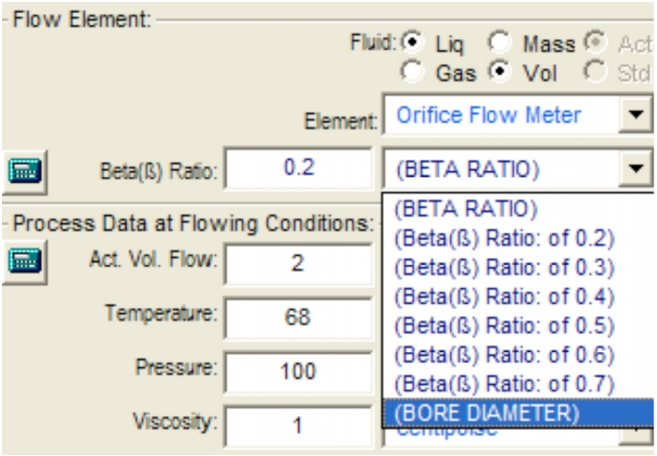
1. Start the Genie program. The following screen will then display.



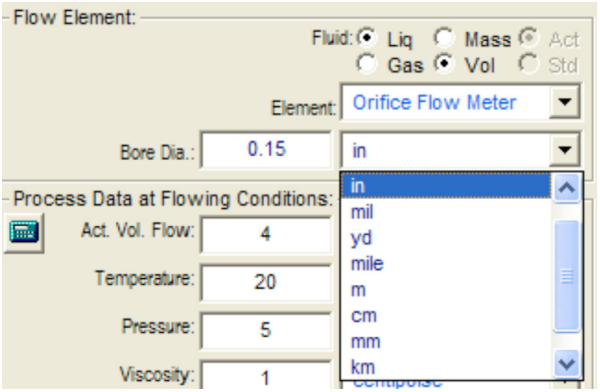
2. In the *Element* pulldown, select *Orifice Flow Meter*.
3. In the *Flow Element* section, use the *Fluid* radio buttons to select either *Liquid* or *Gas* and to select either *Mass* or *Volume* units.
4. Select the Pipe *Diameter* (½, 1 or 1.5 in.) and *Schedule* (40S or 80S). Ignore the Flange *Type* and *Rating*.



5. In the *Beta (B) ratio* pulldown, select *Bore Diameter*



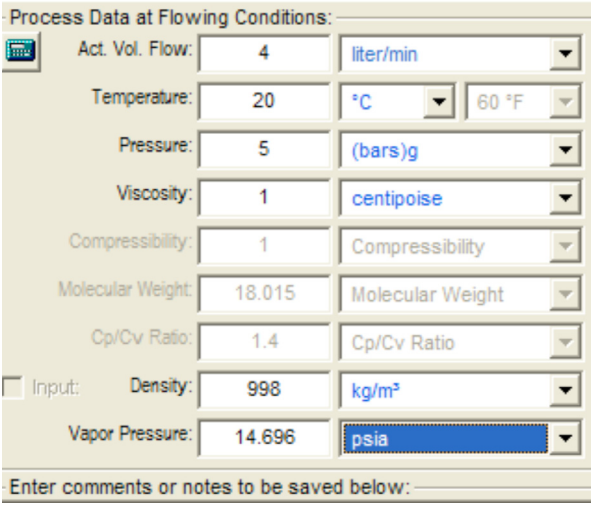
6. The parameter will change to read Bore Dia. Select the appropriate units (in. or mm.)



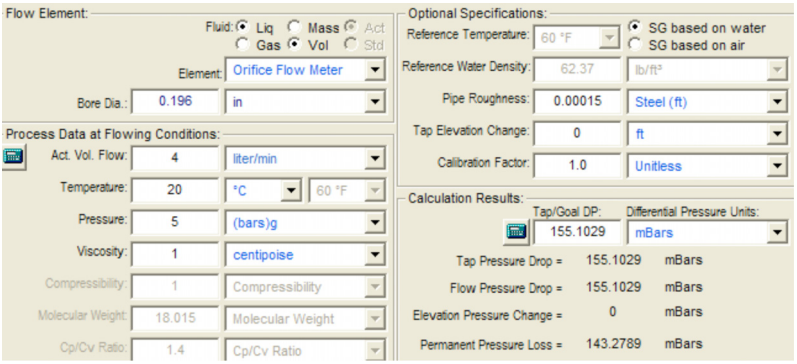
7. If the actual orifice bore is not already known, enter initially a value of bore in the middle of the range available for the meter size chosen, for example :

Size	Suggested Bore
½ in.	0.15 in
1 in.	0.196 in.
1½ in.	0.75 in

8. Enter the process data, selecting the appropriate units for each parameter.



9. Press the *Calculate* button. Read off the calculated DP.
   If the units need to be amended, select the appropriate units and press the *Calculate* button again to recalculate the DP in the new units
10. In this example the DP and overall pressure loss values are quite high.
    To *reduce* the DP, select the next *higher* bore size and enter the new value into the Orifice Bore box.
    To *increase* the DP, select the next *lower* bore size and enter the new value into the Orifice Bore box.
11. Hit *Calculate* button and read off the new DP and pressure loss.



Repeat steps 10 and 11 until an acceptable DP is found.

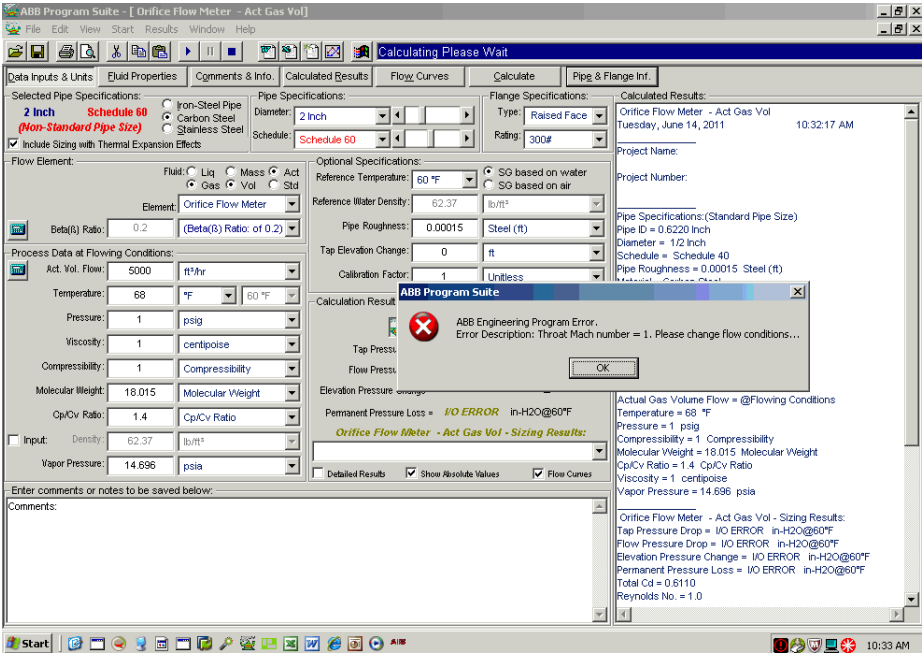
Record the values of the chosen orifice bore and the resultant DP value. They will be needed when the product is coded in ConfigurX to select the appropriate orifice bore and Transmitter element (DP Span).

For the latter, for optimum accuracy always choose the element with the lowest DP span that will accommodate the calculated DP.

2.4 Error Messages

Depending on the process condition entered the program may indicate errors associated with non-standard pipe size, high pressure drop, high velocities, cavitation or other potential problems.

If this occurs it may be necessary to revise the process data or change the pipe size.



Appendix A Fluid Properties Screen

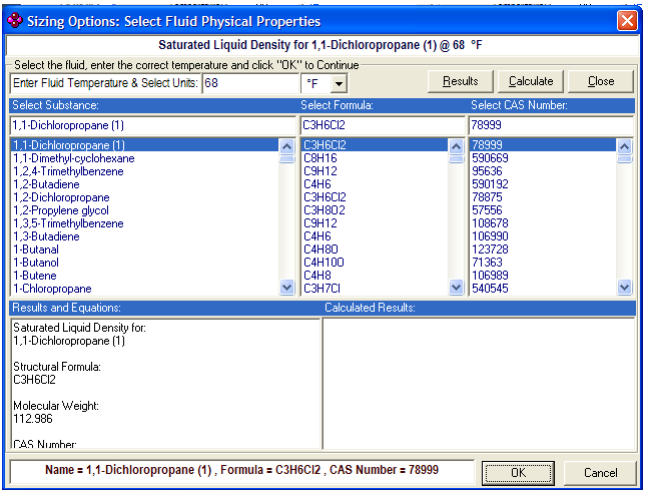
The Fluid Properties Screen sets all fluid properties based on the fluid selected. Options available are *Process Data @ Flowing Conditions, Flow Rate @ Flowing conditions* and *Specific Gravity @ Flowing Conditions*. If you have opted to enter or change information, click on Apply once all changes are complete.

Fluid Properties @ Flowing Conditions

This provides 4 options. Click on the relevant button.

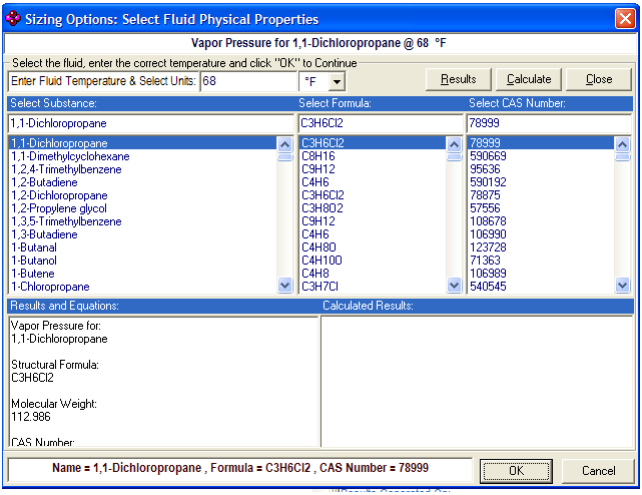
1. **Liquid Density**

   Simply select the fluid, enter the correct temperature and click OK to continue.

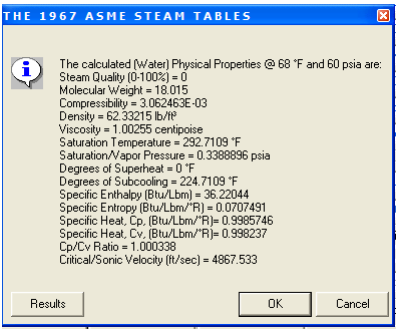


2. **Vapor Pressure**

   Simply select the fluid, enter the correct temperature and click OK to continue.

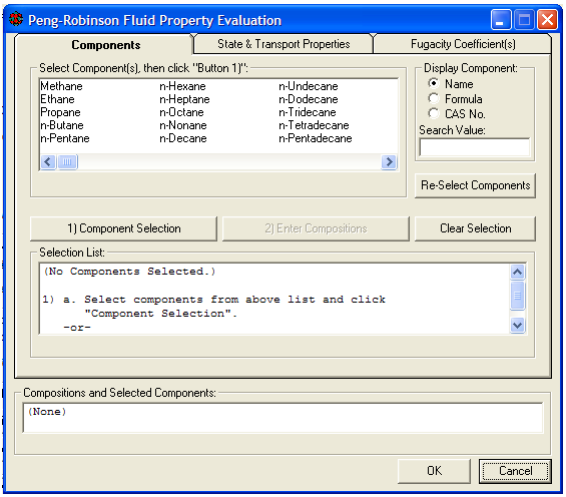


3. **Steam/Water Density**



4. **Peng-Robinson** (Fluid Property Evaluation)

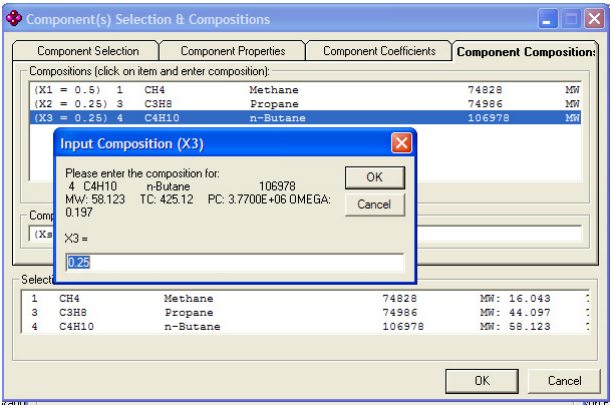
   Peng Robinson allows the user to enter a gas mixture and will then calculate density and other parameters for the pressure and temperature entered on the main sizing screen.



(1) Ensure that the working pressure and temperature for the gas mixture (whether standard or flowing conditions) has been entered on the previous screen.

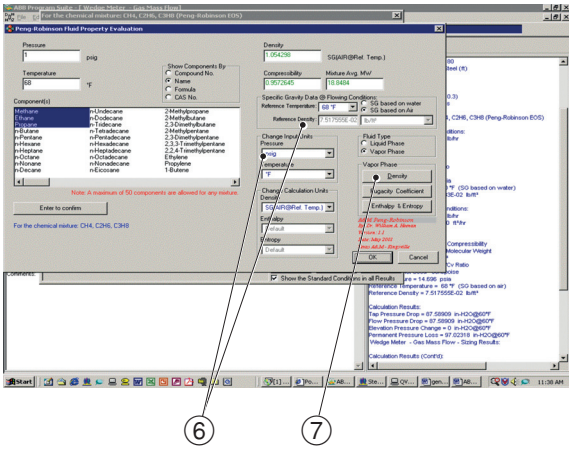
(2) To set up a gas mixture, click on the 1st component required with the left mouse key. For subsequent components hold down the CTRL key and click on required components with left mouse key.

(3) Once components are selected, click on the enter button to confirm entry, the next screen will appear.



(4) Click on each compound in turn and enter the fraction of the mix for that component. The fraction is entered in a format such that 90%=0.9; 50% = 0.5; 10% = 0.1 etc. The composition sum must equal 1 or an error message will appear.

(5) Click enter to confirm to return to previous screen



(6) Change any units required; ensure that the proper S.G. reference, fluid type and calculation units are selected.

(7) Click on the density button and the density, compressibility and MW will be calculated. The data will then import to the previous screen.

Repeat procedure for flowing conditions if required.

Notes

Products and customer support

Automation Systems
For the following industries:
— Chemical & Pharmaceutical
— Food & Beverage
— Manufacturing
— Metals and Minerals
— Oil, Gas & Petrochemical
— Pulp and Paper

Drives and Motors
— AC and 6 Drives, AC and DC Machines, AC Motors to 1kV
— Drive Systems
— Force Measurement
— Servo Drives

Controllers & Recorders
— Single and Multi-loop Controllers
— Circular Chart and Strip Chart Recorders
— Paperless Recorders
— Process Indicators

Flexible Automation
— Industrial Robots and Robot Systems

Flow Measurement
— Electromagnetic Flowmeters
— Mass Flowmeters
— Turbine Flowmeters
— Wedge Flow Elements

Marine Systems & Turbochargers
— Electrical Systems
— Marine Equipment
— Offshore Retrofit and Refurbishment

Process Analytics
— Process Gas Analysis
— Systems Integration

Transmitters
— Pressure
— Temperature
— Level
— Interface Modules

Valves, Actuators and Positioners
— Control Valves
— Actuators
— Positioners

Water, Gas & Industrial Analytics Instrumentation
— pH, Conductivity and Dissolved Oxygen Transmitters and Sensors
— Ammonia, Nitrate, Phosphate, Silica, Sodium, Chloride, Fluoride, Dissolved Oxygen and Hydrazine Analyzers
— Zirconia Oxygen Analyzers, Katharometers, Hydrogen Purity and Purge-gas Monitors, Thermal Conductivity

Customer support
We provide a comprehensive after sales service via a Worldwide Service Organization. Contact one of the following offices for details on your nearest Service and Repair Centre.

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Fax: +44 (0)1453 829671

USA
ABB Inc.
Tel: +1 215 674 6000
Fax: +1 215 674 7183

Client Warranty
Prior to installation, the equipment referred to in this manual must be stored in a clean, dry environment, in accordance with the Company's published specification.
Periodic checks must be made on the equipment's condition. In the event of a failure under warranty, the following documentation must be provided as substantiation:
— A listing evidencing process operation and alarm logs at time of failure.
— Copies of all storage, installation, operating and maintenance records relating to the alleged faulty unit.

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