

SI CALCULATION MODULE

Dee Dee Honea
Eichleay SPI SME

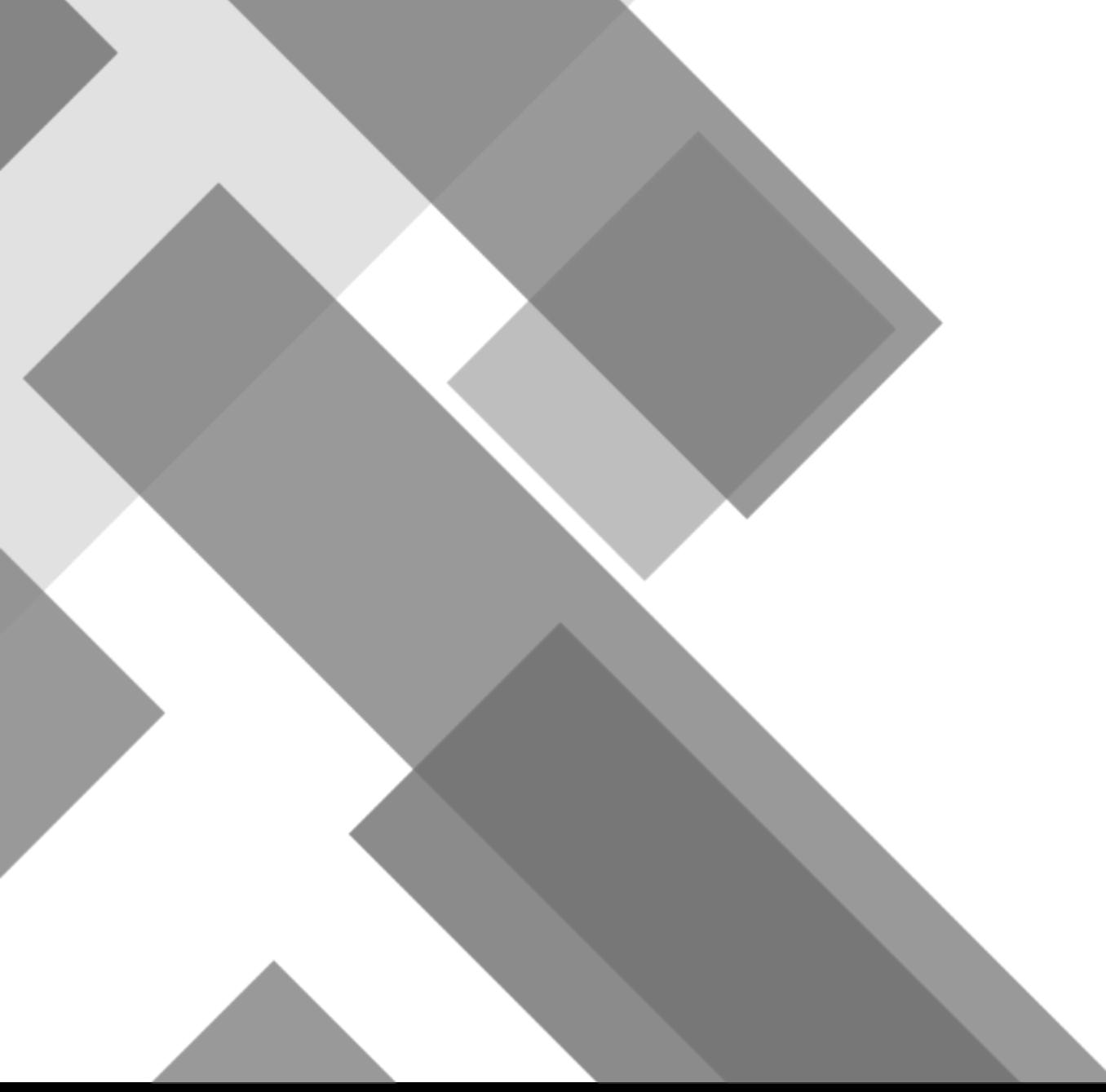
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AGENDA

- **Types of Calculations**
- **Pre-Calculation Data**
- **Process Data**
- **Calculations**
 - **Flowmeter**
 - **Control Valve**
- **Best Practices**



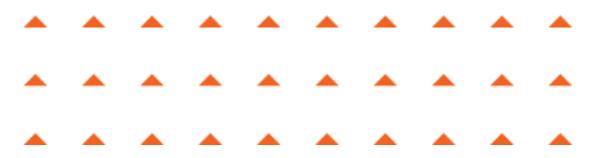


TYPES OF CALCULATIONS



TYPES OF CALCULATIONS

- **Flowmeter** – Orifice diameter, full scale flow, or differential range
- **Thermowell** – Maximum thermowell length, and wake frequency or velocity calculation
- **Control Valve** – Valve sizing
- **Relief Valve** – Size of relief valve for fire or non-fire
- Batch calculations for flow, temp, control valves and relief valves

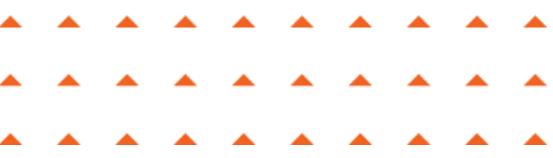


PRE-CALCULATION DATA



PRE-CALCULATION DATA

- Tag Number
- Line Number
- Pipe Spec & Pipe Schedule
- Line Size at the Orifice
- John Dressel's shoe size
- Phase of the Moon
- Temperature at George Bush Airport at Noon on the day of the Calculation



PRE-CALCULATION DATA-TAG NUMBER & TYPE

Create loop and tags

- ✓ Q0100-F-2354
- ✓ E Q0100-F-2350
- ✓ E Q0100-F-2351
- ✓ E Q0100-F-2370
- ✓ E Q0100-F-2490A
- ✓ E Q0100-F-2490B
- ✓ E Q0100-F-2490C
- ✓ E Q0100-F-2492
- ✓ E Q0100-F-2515
- ✓ E Q0100-F-2525
- ✓ Q0100-F-WINE
 - ✓ Q0100:FE WINE
 - ✓ Q0100:FV WINE
- ✓ Q0100-H-0182
- ✓ E Q0100-H-0210
- ✓ E Q0100-H-0224
- ✓ E Q0100-H-0283A
- ✓ E Q0100-H-0283B
- ✓ E Q0100-H-0322
- ✓ Q0100-H-0426

Tag Number Properties

General	Power Supply	Associations	Custom Tables	Custom Fields	Associate Symbols
Loop data					
Loop number: Q0100-F-WINE					
Properties... New Loop... Associate...					
Tag number properties					
Tag class: Conventional					
Number: Q0100:FE WINE					
Service: WINE FROM CROSSFLOW FEED PUMP					
Instrument type: FE (314) Orifice Plate FE					
Status: New Device					
Location: FIELD					
I/O type: *					
Certification:					

Tag Number Properties

General	Power Supply	Associations	Custom Tables	Custom Fields	Associate Symbols
Loop data					
Loop number: Q0100-F-WINE					
Properties... New Loop... Associate...					
Tag number properties					
Tag class: Conventional					
Number: Q0100:FV WINE					
Service: WINE FROM CROSSFLOW FEED PUMP					
Instrument type: FV (202) Control Valve FV					
Status: New Device					
Location: FIELD					
I/O type: *					
Certification: *					
Old tag number:					
Internal loop order: 2					
Equipment: *					
Line: 4"-WFR-1009-P1					
P&ID: Q0100-YD-001-001					
Manufacturer: MASONEILAN					
Model:					
Intrinsically safe circuit type:					

PRE-CALCULATION DATA-LINE NUMBER

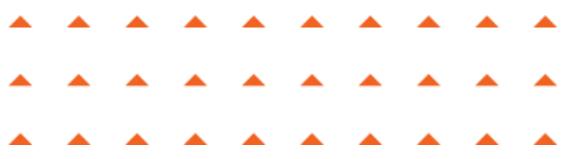


Create new line number including pipe spec, pipe size and pipe schedule or use existing line.

The screenshot shows a software application window with three main components:

- Number Properties** (Background Window):
 - General tab selected.
 - Loop data: Loop number: 0100-F-WINE.
 - Tag number properties: Tag class: Conventional; Number: 0100:FE_WINE; Service: WINE FROM CROSSFLOW FEED PUMP.
 - Instrument type: FE (314) Orifice Plate FE.
 - Status: New Device.
 - Location: FIELD.
 - I/O type: *.
 - Certification: *.
 - Signal type.
 - Linear type.
 - Requires power supply:
- Line Properties** (Middle Window):
 - Line number: 4"-WFR-1009-P.
 - Line type: WFR.
 - P&ID: 0100-YD-001-001.
 - Stream name: WINE.
 - Pipe material: 316 S.S.
 - Pipe spec: P.
- Pipe Data Library** (Foreground Window):
 - Find nominal size: WINE.
 - Table of Pipe Data:

Nominal Size (inch)	Pipe Schedule	Internal Diameter (inch)	Wall Thickness (inch)	Default
4	40S	4.0260	0.2370	Yes
4	10S	4.2600	0.1200	Yes
4	5S	4.3340	0.0830	Yes
5	80S	4.8130	0.3750	Yes
5	40S	5.0470	0.2580	Yes
5	10S	5.2950	0.1340	Yes
5	5S	5.3450	0.1090	Yes
6	160	5.1880	0.7204	No



PROCESS DATA

PROCESS DATA

To open the process data module, click on the process data icon at the top or from an EDE view, right click on the tag and go to Actions>Open Process Data or open the process data sheet under the tag.

The screenshot shows the SmartPlant P&ID software interface. At the top, there is a menu bar with File, Modules, SmartPlant, Tools, Window, and Help. Below the menu is a toolbar with icons for Close, Open lowe..., Generate R..., Calculation, Index, EDE, Wiring, Process Da..., and Loop Dwg\$. The 'Process Da...' icon is highlighted with a red box. On the left, there is a tree view of the process data structure:

- 0100-F-WINE
 - 0100:FE WINE
 - 0100:FE WINE-PD
 - 0100:FF WTMFL-SD

In the center, there is a table titled "Process Data" with columns: Tag Number, Instrument Type, Tag Class, and Service. The table contains five rows of data:

Tag Number	Instrument Type	Tag Class	Service
0100:FE 0001	FE - FE (314) Orifice Plate	Conventional	G-2 RCYCL PMP DISCH
0100:FE 0002	FE - FE (314) Orifice Plate	Conventional	G-3 RCYCL PMP DISCH
0100:FE 0003	FE - FE (314) Orifice Plate	Conventional	G-4 RCYCL PMP DISCH
0100:FE 0004	FE - FE (314) Orifice Plate	Conventional	G-5 RCYCL PMP DISCH
0100:FE WINE	FE - FE (314) Orifice Plate	Conventional	WINE FROM CROSSFLOW FEED PUMP

A context menu is open over the last row (0100:FE WINE). The menu items are:

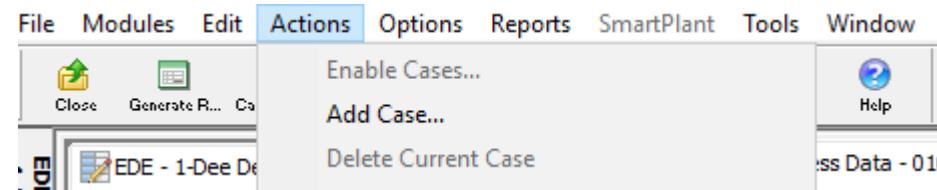
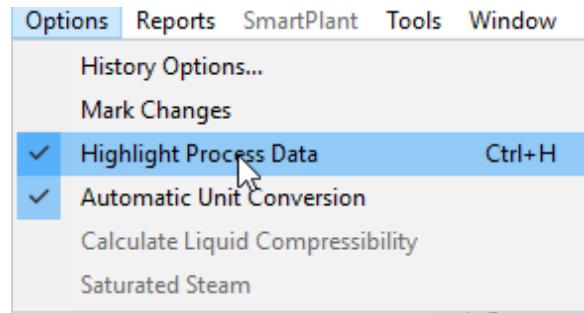
- New
- Actions
 - Enhanced Report Layouts...
 - I/O Assignment...
 - Generate a Specification...
 - Generate a Process Data Sheet...
 - Create Control System Tag...
 - Create Device Panel and Cable...
 - Device Panel Connection...
 - Associate Instrument Blocks...
 - Change Block Association Method
 - Update Block Assignments...
 - Multi-Input Device Tag Association ...
 - Batch Symbol Association...
 - Open Specification
- Properties
- Duplicate
- Delete
- Go To Item
- Add to Favorites...
- Filter...
- Show EDE...
- Copy Ctrl+C
- Paste Ctrl+V

The "Open Process Data" option is highlighted with a red box.

PROCESS DATA



Before entering Process Data, click under options and check “Highlight Process Data” and “Automatic Unit Conversion” **Caution:** Automatic Unit Conversion will automatically change the data if the UOM’s are changed. Click on Actions>Enable Case if you have more than one case.



GENERAL	
Case:	Case 1
Service:	Governing
Fluid state:	Case 1
Fluid phase:	0
Fluid name source:	Case 2

PROCESS DATA

Complete the General Information by using the pull-down menus. The fluid name source: database is pre-defined options.

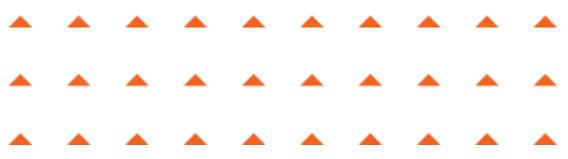
Fluid Name	Fluid Formula	Chemical Abstracts Name
1,2-BUTADIENE	C4H6	1,2-BUTADIENE
1,2-DICHLOROETHANE	C2H4CL2	ETHANE, 1,2-DICHLORO-
1,2-DIMETHYLBENZENE	C8H10	BENZENE, 1,2-DIMETHYL-
1,2-ETHANEDIOL	C2H6O2	1,2-ETHANEDIOL

PROCESS DATA

All “Cyan” and “Yellow” highlighted fields must be completed for calculation to run. Choose Density or Specific Gravity. Be sure and save data before exiting.

GENERAL					
Case:	Case 1				
Service:	WINE FROM CROSSFLOW FEED PUMP	Location:	Line	Line number:	4T-WFR-1009-P1
Fluid state:	Liquid	Line size:	4	In	
Fluid phase:	Single phase	Line schedule:	40S		
Fluid name source:	User-defined				
Fluid name:	WINE				
Process Data UDF 001					
Process Data UDF 002					
PROPERTIES					
Report flags:	Density	@Minimum	@Normal	@Maximum	Units
Volumetric flow:	100	200	USgal/min	@standard	
Upstream pressure:	50	60	psi	gage	
Temperature:	60	60	°F		
Viscosity:	1.123	1.123	cP		
Velocity:	2.52	14.7	ft/s		
Density:	63.67	63.67	lb/ft ³		
Specific gravity:	1.02	1.02			
Compressibility:					
Specific heat ratio:					
Vapor pressure:	0.9502	0.2577	0.2577	psi	absolute
Critical pressure:	3204			psi	absolute
Molecular mass:					
Process Data UDF 003					
Process Data UDF 004					
ADDITIONAL PROPERTIES					
Design pressure minimum:	psi	gage	Corrosive:	No	
Design pressure maximum:	155	psi	Erosive:		
Design temperature minimum:		°F	Toxic:	No	
Design temperature maximum:	120		Colored:	Yes	
Entrained gas:	%		Transparent:	No	
Angle of repose:	°		Build-up tendency:	Yes	
Required range:	From:	To:	US bbl/d	@flow	
Limits on press.drop across flowmeter:			inH2O		
Process Data UDF 005					
Process Data UDF 006					
BASE CONDITIONS					
Pressure:	14.7	psi	absolute	Density:	63.67 lb/ft ³

PROPERTIES					
Density			@Maximum	Units	
100	200	USgal/min	@standard		
50	60	psi	gage		
60	60	°F			
0.681		cP			
2.52	14.7	ft/s			
62.01		lb/ft ³			
0.994					
0.9502	0.9502	psi	absolute		
3198		psi	absolute		



CALCULATIONS

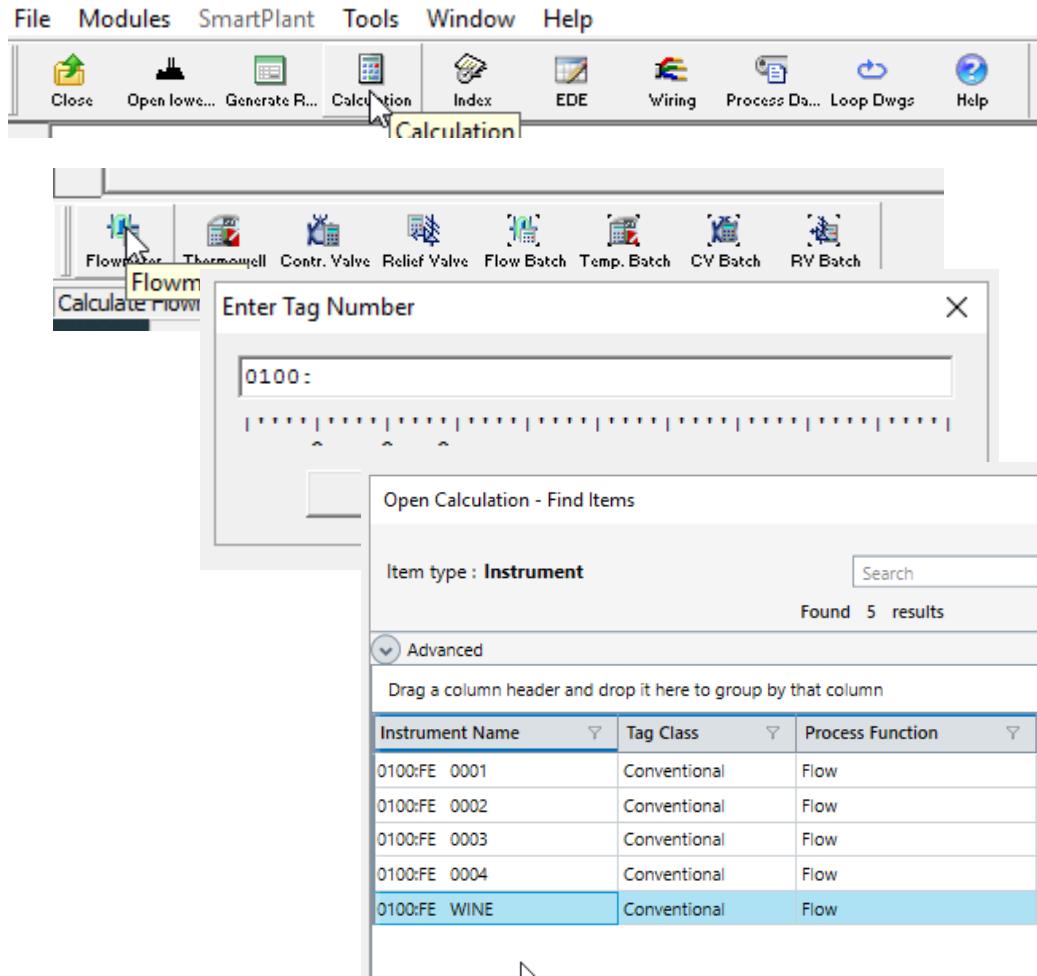
CALCULATIONS: FLOWMETER

Make sure all process data is complete. Save data and open the calculation module.

GENERAL					
Case:	Case 1				
Service:	WINE FROM CROSSFLOW FEED PUMP		Location:	Line	
Fluid state:	Liquid	Line number:	4"-WFR-1009-P1		
Fluid phase:	Single phase	Line size:	4	In	
Fluid name source:	User-defined	Line schedule:	40S		
Fluid name:	FINISHED WINE				
Process Data UDF 001					
Process Data UDF 002					
PROPERTIES					
Report flags:	Density	@Minimum	@Normal	@Maximum	Units
Volumetric flow:	100	200	USgal/min	@standard	
Upstream pressure:	50	60	psi	gage	
Temperature:	60	60	°F		
Viscosity:	1.123	1.123	cP		
Velocity:	2.52	14.7	ft/s		
Density:	63.67	63.67	lb/ft ³		
Specific gravity:	1.02	1.02			
Compressibility:					
Specific heat ratio:					
Vapor pressure:	0.9502	0.2577	0.2577	psi	absolute
Critical pressure:	3204			psi	absolute
Molecular mass:					
Process Data UDF 003					
Process Data UDF 004					
ADDITIONAL PROPERTIES					
Design pressure minimum:	psi	gage	Corrosive:	No	
Design pressure maximum:	155	psi	Erosive:		
Design temperature minimum:		°F	Toxic:	No	
Design temperature maximum:	120		Colored:	Yes	
Entrained gas:	%		Transparent:	No	
Angle of repose:	°		Build-up tendency:	Yes	
Required range:	From:	To:	US bbl/d	@flow	
Limits on press.drop across flowmeter:	inH2O				
Process Data UDF 005					
Process Data UDF 006					
BASE CONDITIONS					
Pressure:	14.7	psi	absolute	Density:	63.67 lb/ft ³
Temperature:	60	°F		Specific gravity:	1.02
Compressibility:					

CALCULATIONS: FLOWMETER (CONT.)

There are multiple ways to open the calculation module. Click on the Calculation Icon at the top, click on Flowmeter at the bottom. Enter the tag number or do a “Find” and it will come up in an EDE view.



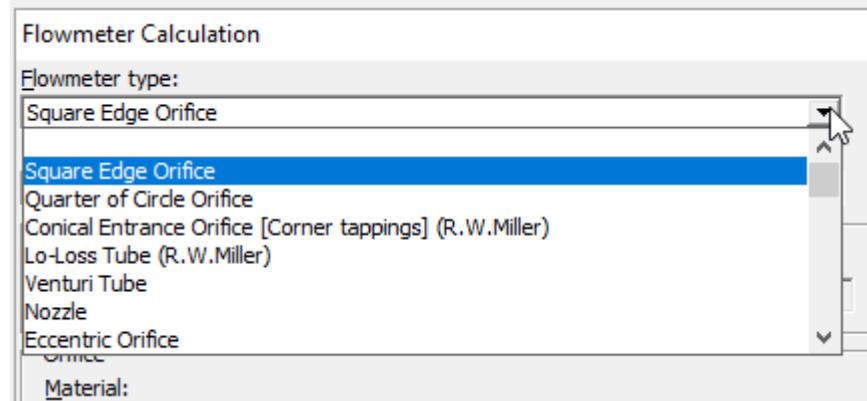
Tag Number	Instrument Type	Tag Class	Service
0100:FE 0001	FE - FE (314) Orifice Plate	Conventional	G-2 RCYCL PMP DISCH
0100:FE 0002	FE - FE (314) Orifice Plate	Conventional	G-3 RCYCL PMP DISCH
0100:FE 0003	FE - FE (314) Orifice Plate	Conventional	G-4 RCYCL PMP DISCH
0100:FE 0004	FE - FE (314) Orifice Plate	Conventional	G-5 RCYCL PMP DISCH
0100:FE WINE	FE - FE (314) Orifice Plate	Conventional	WINE FROM CROSSFLOW

A context menu is open on the last row (0100:FE WINE). The menu items are:

- New
- Actions
- Reports
- Project Activities
- Properties
- Duplicate
- Delete
- Go To Item
- Add to Favorites...
- Filter...
- Show EDE...
- Copy Ctrl+C
- Paste Ctrl+V
- Open Calculation (highlighted)
- Open Calibration

CALCULATIONS: FLOWMETER (CONT.)

Use the pull-down menus to further refine your device. You can calculate Orifice Diameter, Full scale flow or Differential range of an orifice plate. Two of the three need to be filled in to calculate the third. Click on the “Calculate” icon at the bottom.



In this case the beta ratio was calculated to be 0.5819. Optimal beta ratios are between 0.3 and 0.7

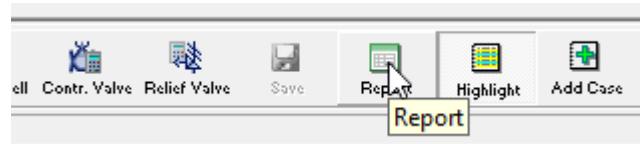
The screenshot shows the "Flowmeter Calculation" dialog box with the following details:

- Flowmeter type:** Square Edge Orifice
- Sub type:** Flange Tappings [ISO 5167 (1998)/ R.W.Miller]
- Pipe:** Material: 316 S.S. Linear expansion coefficient: 0.000007111 1/PF
- Orifice:** Material: 301 S.S. Linear expansion coefficient: 0.000007611 1/PF
- Discharge coefficient:** Water in steam, % wt: 0
- Beta ratio:** 0.5819 (highlighted with a red oval)
- Select calculate field:**
 - Orifice diameter: Units: 0 in
 - Full scale flow: Units: 200 USgal/min @standard Refresh
 - Differential range Units: 100 inH2O
- Pressure loss:** 63.94 inH2O
- Standard conditions:** T=15.6 °C (60 °F)
- Default:** Bleed/vent hole diameter = 0

At the bottom right of the dialog box are buttons for "Close", "Calculate", and "Help".

CALCULATIONS: FLOWMETER (CONT.)

To create a report of the calculation, Click on the Report icon at the bottom. You can also add a revision.



Flowmeters:Orifice diameter calculation

Square edge orifice with flange tappings
The Flowmeter is sized according to ISO 5167-1 (1998) / R.W. Miller, Flow Meas. Eng. Handbook (1996)

0100:FE WINE
Case: Case 1
WINE FROM CROSSFLOW FEED PUMP
State: LIQUID
Fluid: FINISHED WINE

	Unit	Value
Full scale flow @ Standard conditions	USgal/min	200
Operating flow @ Standard conditions	USgal/min	100
Upstream pressure	psi-g	50
Operating temperature	°F	60
Density @ operating conditions	lb/ft ³	63.67
Density@ Standard conditions	lb/ft ³	63.67
Viscosity	cP	1.123
Ambient temperature	°F	68
Differential range	inH ₂ O	100

Pipe material:
316 S.S.
Pipe linear expansion coefficient : 0.000007111 1/°F
Line size & Schedule: 4 in, sch 40S
Pipe diameter: 4.026 in
Orifice material:
301 S.S.
Orifice linear expansion coefficient : 0.000007611 1/°F

	Unit	Value
Orifice diameter	in	2.3427
Beta ratio		0.5819
Pressure loss @ maximum flow	inH ₂ O	63.94
Pressure loss @ operating flow	inH ₂ O	15.99
Pipe Reynolds number @ operating flow		71351
Discharge coefficient		0.6112
True maximum flow @ Standard conditions	USgal/min	199.3
		±1.03%

- Standard conditions: T=15.6 °C (60 °F)
- Default: Bleed/vent hole diameter = 0

CALCULATIONS: FLOWMETER (CONT.)

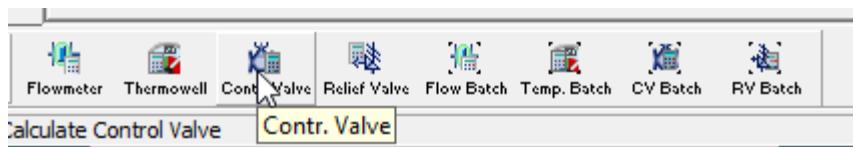
The most commonly used method today is to use a standard bore size orifice plate and adjust the differential pressure to get the required flow.

The screenshot shows a software window titled "Flowmeter Calculation". The "Flowmeter type:" dropdown is set to "Square Edge Orifice" and the "Sub type:" dropdown is set to "Flange Tappings [ISO 5167 (1998)/ R.W.Miller]". Under the "Pipe" section, the "Material:" dropdown is set to "316 S.S." and the "Linear expansion coefficient:" dropdown is set to "0.000007111 1/F". Under the "Orifice" section, the "Material:" dropdown is set to "301 S.S." and the "Linear expansion coefficient:" dropdown is set to "0.000007611 1/F". The "Discharge coefficient:" input field contains "0.608" and the "Water in steam, % wt:" input field contains "0". A checked checkbox labeled "Calculate discharge coefficient" is present. The "Diameter of bleed/vent hole:" input field contains "2.25" with "in" selected as the unit. The "Beta ratio:" input field contains "0.55887". On the right side, there is a "Select calculate field" section with three options: "Orifice diameter: Units: 2.25 in", "Full scale flow: Units: 200 USgal/min @standard Refresh", and "Differential range Units: 121.1 inH2O". At the bottom left, the "Pressure loss:" input field contains "80.73 inH2O". A note at the bottom states "- Standard conditions: T=15.6 °C (60 °F)
- Default: Bleed/vent hole diameter = 0". At the bottom right, there are "Close", "Calculate", and "Help" buttons.

CALCULATIONS: VALVES



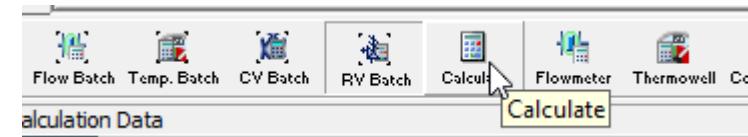
The procedure for inputting process data and opening the Calculation module are the same for valve sizing.
Click on the Control Valve icon or open via an EDE.



CALCULATIONS: VALVES (CONT.)

The procedure for inputting process data and opening the Calculation module are the same for valve sizing. Click on the Control Valve icon or open via an EDE. Once all required process data fields are completed, click on the Calculate icon at the bottom.

GENERAL					
Case:	WINE FROM CROSSFLOW FEED PUMP				
Service:	Liquid	Location:	Line	Line number:	4"-WFR-1009-P1
Fluid state:		Line size:	4	in	
Fluid phase:		Line schedule:	40S		
Fluid name source:	User-defined				
Fluid name:	FINISHED WINE				
Associated line:					
Line size:					
Process Data UDF 001					
Process Data UDF 002					
PROPERTIES					
Report flags:	Density	@Minimum	@Normal	@Maximum	Units
Volumetric flow:	100	100	200	USgal/min	@flow
Upstream pressure:	50	50	60	psi	gage
Downstream pressure:	45	45	55	psi	gage
Pressure drop:	5	5	5	psi	
Temperature:	60	60	60	°F	
Viscosity:	0.681	0.681	0.681	cP	
Density:	62.01	62.01	62.01	lb/ft ³	
Specific gravity:	0.994	0.994	0.994		
Compressibility:					
Specific heat ratio:					
Vapor pressure:				psi	absolute
Critical pressure:				psi	gage
Molecular mass:					
Process Data UDF 003					
Process Data UDF 004					



CALCULATIONS: VALVES (CONT.)

Refine your valve data by using the pull-down menus on the Calculation window. Click calculate when completed.

Control Valve Calculation

Calculation method:	ISA	Noise calculation method:	Masoneilan
Flow coefficient:	Cv	Body type:	Single Seat Globe
Critical flow factor (Fl,Cf):	0.86	@Minimum	0.86
Pressure drop ratio factor (Xt):	0.86	@Normal	0.86
Valve style modifier (Fd):	1	@Maximum	0.86
Relative capacity (Cv/d ²):	12.3	<input type="checkbox"/> Calculate pressure drop ratio factor	
Number of flow passages:	1	Valve size:	4 in
Characteristic pressure ratio (Xfz):		Outlet pipe diameter:	4.026 in
Acoustical efficiency factor (Ef):	*10 ⁻⁸	Density of pipe material (Rop):	lb/ft ³
Correction value (Delf):		Bulk Modulus:	psi
Speed of sound in the pipe wall (Cp):	ft/s		
Cv	@Minimum	@Normal	@Maximum
Regime	Turbulent	Turbulent	Turbulent
Noise	54.4	54.4	57.4

Close Calculate Help

Control Valve Calculation

Calculation method:	ISA	Noise calculation method:	Masoneilan
Flow coefficient:	Cv	Body type:	Single Seat Globe
Critical flow factor (Fl,Cf):	0.86	@Minimum	0.86
Pressure drop ratio factor (Xt):	0.86	@Normal	0.86
Valve style modifier (Fd):	1	@Maximum	0.86
Relative capacity (Cv/d ²):	12.3	<input type="checkbox"/> Calculate pressure drop ratio factor	
Number of flow passages:	1	Valve size:	4 in
Characteristic pressure ratio (Xfz):		Outlet pipe diameter:	4.026 in
Acoustical efficiency factor (Ef):	*10 ⁻⁸	Density of pipe material (Rop):	lb/ft ³
Correction value (Delf):		Bulk Modulus:	psi
Speed of sound in the pipe wall (Cp):	ft/s		
Cv	@Minimum	@Normal	@Maximum
Regime	Turbulent	Turbulent	Turbulent
Noise	54.4	54.4	57.4

Close Calculate Help

CALCULATIONS: VALVES (CONT.)

For this calculation the Cv was 44.7-@Minimum, 44.7 - @Normal, and 89.3 - @Maximum with Turbulent flow. Cv is the number of gallons per minute (GPM) a valve will flow with a 1 psi pressure drop across the valve. The formula used to select the valve Cv is $Cv = GPM / (\sqrt{RT(\Delta P)})$. The noise level is measured in Decibels (dB) and is under 85 dB which is the desired maximum.

Speed of sound in the pipe wall (C _p):	ft/s		
Cv	@Minimum 44.7	@Normal 44.7	@Maximum 89.3
Regime	Turbulent	Turbulent	Turbulent
Noise	54.4	54.4	57.4

CALCULATIONS: VALVES (CONT.)

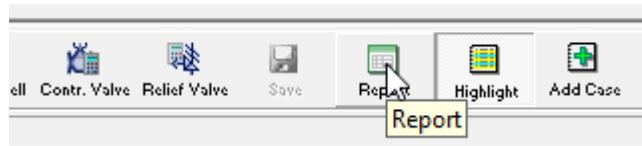
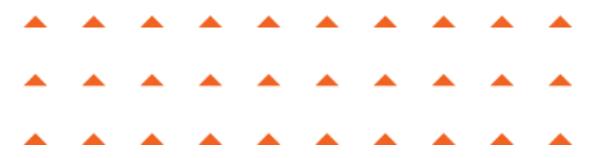


Choose the Cv from the table for the valve and trim size.

Valve Size (in.)	Trim Size (in.)	Stroke (in.)	Cv At Percent Open									
			5	10	20	30	40	50	60	70	80	90
.5	.50	0.75	0.13	0.25	0.33	0.36	0.31	1.4	1.9	2.6	3.7	4.7
	.58	0.75	0.065	0.13	0.19	0.31	0.50	0.66	1.2	1.7	2.5	3.4
	.61	0.75	0.049	0.10	0.15	0.22	0.34	0.59	1.0	1.2	1.8	2.6
	.25A	0.75	0.030	0.060	0.090	0.14	0.23	0.37	0.56	0.81	1.1	1.6
	.25B	0.75	0.0077	0.015	0.032	0.053	0.10	0.16	0.25	0.40	0.63	1.0
	.12A	0.5	0.0075	0.015	0.026	0.043	0.072	0.10	0.17	0.27	0.38	0.45
.75	.72	0.75	0.32	0.63	1.0	1.6	2.3	3.2	3.9	5.6	7.6	9.0
	.62	0.75	0.16	0.32	0.59	0.95	1.6	2.3	3.0	4.6	6.6	8.4
	.50	0.75	0.12	0.24	0.37	0.62	1.0	1.5	1.9	3.0	4.6	5.8
	.38	0.75	0.054	0.11	0.17	0.29	0.47	0.88	1.4	1.8	2.9	3.8
	.31	0.75	0.046	0.092	0.15	0.20	0.31	0.58	0.87	1.2	1.6	2.6
	.25A	0.75	0.030	0.060	0.088	0.14	0.21	0.35	0.58	0.92	1.2	1.8
1	.72	0.75	0.077	0.015	0.032	0.053	0.10	0.16	0.25	0.40	0.63	1.0
	.62	0.75	0.035	0.070	0.11	0.16	0.23	0.31	0.39	0.61	0.89	11.7
	.50	0.75	0.18	0.35	0.61	1.0	1.5	2.3	2.7	4.2	6.5	8.7
	.38	0.75	0.13	0.26	0.46	0.72	1.09	1.5	1.9	2.9	4.4	5.7
	.31	0.75	0.070	0.14	0.22	0.33	0.51	0.84	1.3	1.9	2.3	3.4
	.25A	0.75	0.044	0.088	0.14	0.20	0.35	0.61	0.92	1.1	1.6	2.4
1.5	.72	0.75	0.028	0.056	0.089	0.13	0.21	0.31	0.56	0.83	1.1	1.5
	.62	0.75	0.018	0.038	0.063	0.10	0.16	0.25	0.40	0.63	1.0	1.3
	.50	0.75	0.013	0.028	0.043	0.063	0.085	0.11	0.16	0.22	0.29	0.46
	.38	0.75	0.075	0.15	0.22	0.34	0.55	0.91	1.1	1.7	2.6	3.5
	.31	0.75	0.035	0.070	0.11	0.16	0.23	0.31	0.39	0.61	0.89	11.7
	.25A	0.75	0.020	0.040	0.063	0.10	0.16	0.25	0.40	0.63	1.0	1.3
2	1.25	1	0.77	1.5	2.3	3.5	4.9	6.6	10	15	21	29
	1.00	0.75	0.52	1.0	1.6	2.4	3.3	4.5	7.1	11	14	17
	.81	0.75	0.17	0.33	0.69	1.1	1.8	2.6	4.0	6.3	8.9	11
	.62	0.75	0.13	0.26	0.47	0.76	1.4	2.0	3.0	4.4	6.2	8.0
	.38	0.75	0.054	0.11	0.18	0.30	0.58	0.86	1.2	1.4	1.9	2.8
	.31	0.75	0.035	0.070	0.11	0.16	0.23	0.31	0.39	0.61	0.89	11.7
3	1.62	1.5	1.3	2.6	3.8	5.9	9.0	11	16	25	34	41
	1.25	1	0.78	1.6	2.3	3.6	5.2	6.8	10	16	22	27
	1.00	0.75	0.53	1.1	1.6	2.5	3.3	4.7	7.5	11	15	19
	.81	0.75	0.14	0.27	0.50	1.4	2.1	2.8	4.0	6.2	9.0	12
	.62	0.75	0.10	0.21	0.52	0.88	1.4	2.0	2.8	4.2	6.1	7.9
	.38	0.75	0.075	0.15	0.22	0.34	0.55	0.91	1.1	1.7	2.6	3.5
4	2.62	2	2.9	5.6	10	16	22	36	60	76	85	95
	2.00	1.5	1.9	3.7	6.3	8.8	13	24	40	55	66	73
	1.62	1.5	1.3	2.5	3.6	5.7	8.4	11	16	24	36	46
	1.25	1	0.69	1.4	2.0	3.1	4.2	6.6	12	18	24	29

CALCULATIONS: VALVES (CONT.)

To create a report, click on the Report icon at the bottom. You can also add a revision.



Control Valve: Cv Calculation

0100:FV WINE

Case:

WINE FROM CROSSFLOW FEED PUMP

The Control Valve is sized according to ISA-75.01(1995)

Hydrodynamic Noise is calculated according to Masoneilan OZ 3000E (1984)

State: LIQUID

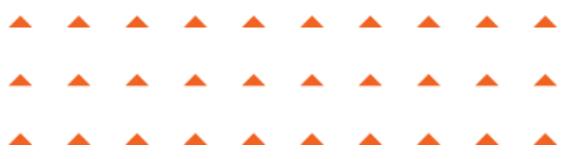
Fluid: FINISHED WINE

Flow	Unit	@ Min. Flow	@ Normal Flow	@ Max. Flow
Upstream pressure	USgal/min	100	100	200
Downstream pressure	psi-g	50	50	60
Differential pressure	psi-g	45	45	55
Temperature	psi	5	5	5
Density	°F	60	60	60
Viscosity	lb/ft³	62.01	62.01	62.01
Vapor pressure	cP	0.681	0.681	0.681
Critical pressure	psi-a			

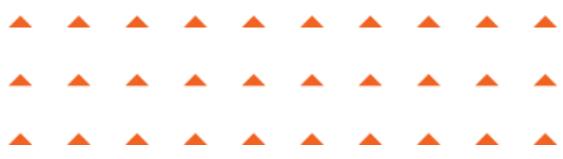
Line size & Schedule:
Pipe inlet/outlet diameter - Wall thickness: 4 in, sch 40S
Valve diameter: 4.026 / 4.026 in
Valve type: 0.237 in Single Globe

Results and Coefficients		@ Min. Flow	@ Normal Flow	@ Max. Flow
Calculated Cv	Cv	44.7	44.7	89.3
Flow regime or condition		Turbulent	Turbulent	Turbulent
Valve Reynolds number	(Re)	406926	406926	578234
Reynolds number factor	(Fr)	1	1	1
Outlet pipe velocity	[ft/s]	2.52	2.52	5.04
Hydrodynamic noise	[dBA]	54.4	54.4	57.4
Pressure recovery factor	(F _P)	0.86	0.86	0.86
Pressure recovery factor	(F _{Pp})	0.86	0.86	0.86
Piping geometry factor	(F _P)	1	1	1
Critical pressure factor	(F _f)	0.96	0.96	0.96
Cavitation index	(K _c)	0.07728	0.07728	0.06694
Valve cavitation index	(K _{cv})	0.5636	0.5636	0.5636
Max. allow. diff. pressure	[psi]	47.85	47.85	55.25
Valve style modifier	(F _d)		1	
Inlet vel. head coefficient	(K _i)		0	
Total vel. head coefficient	(Σ _k)		0	

- Default: Critical Pressure = 0 bar-a
- Default: Vapor Pressure at minimum flow = 0 psi-a
- Barometric Pressure: 1.00 atm(stand)
- Default: Vapor Pressure at normal flow = 0 psi-a
- Default: Vapor Pressure at maximum flow = 0 psi-a



BEST PRACTICES



BEST PRACTICES

- Calculations are generic for flowmeter and valve sizing. Manufacturers use calculation methods specific to their products. Review all data with Manufacturers.
- Check PID's for correct orifice or valve size
- Set UOM before adding process data
- Print existing data before changing
- Density option is flowing density not base density
- Use compressibility option when calculating gases/vapors



BEST PRACTICES (CONT.)

- Cyan fields are required, yellow are recommended
- Use "0" and not "O" in process data
- Save data before exiting
- The more data, the better



Questions?

