FluidFlow

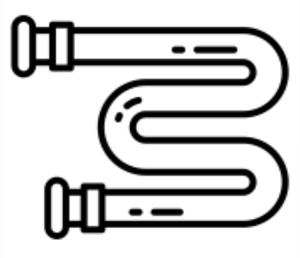
FluidFlow Liquid & Gas Demonstration

Discussion Outline

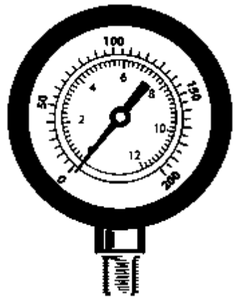
1. FluidFlow: Hydraulic Calculation Software Objectives
2. FluidFlow User Interface
3. FluidFlow Database
4. FluidFlow Design and Rating Case Mode
5. FluidFlow Modules
6. FluidFlow Special Features
7. Basic and Advanced Training

FLUIDFLOW:
HYDRAULIC CALCULATION SOFTWARE OBJECTIVES

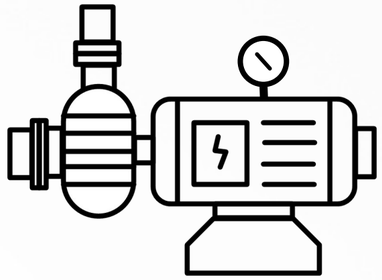
FluidFlow: Hydraulic Calculation Software Objectives



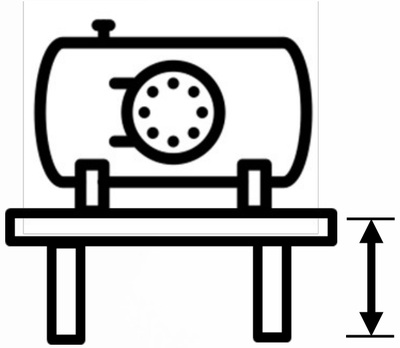
LINE SIZING



OPERATING PRESSURE



EQUIPMENT SPECIFICATION



ELEVATION



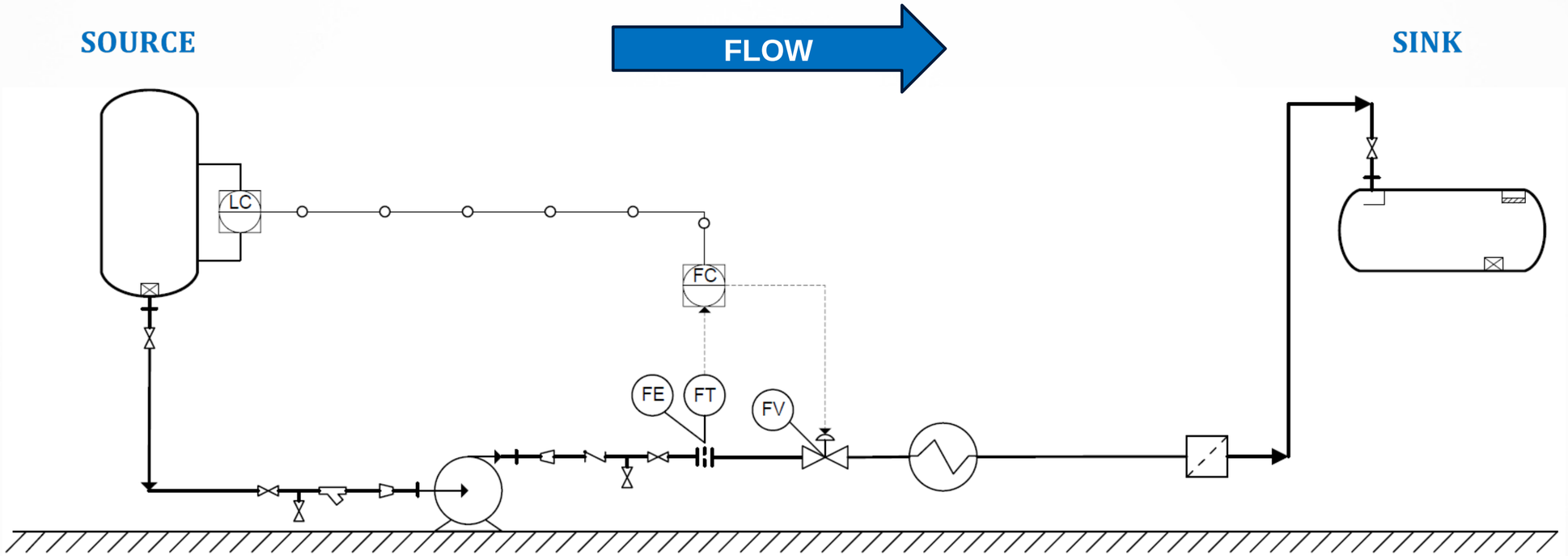
INSTRUMENT SPECIFICATION



FLOW REGIME (FOR TWO-PHASE)

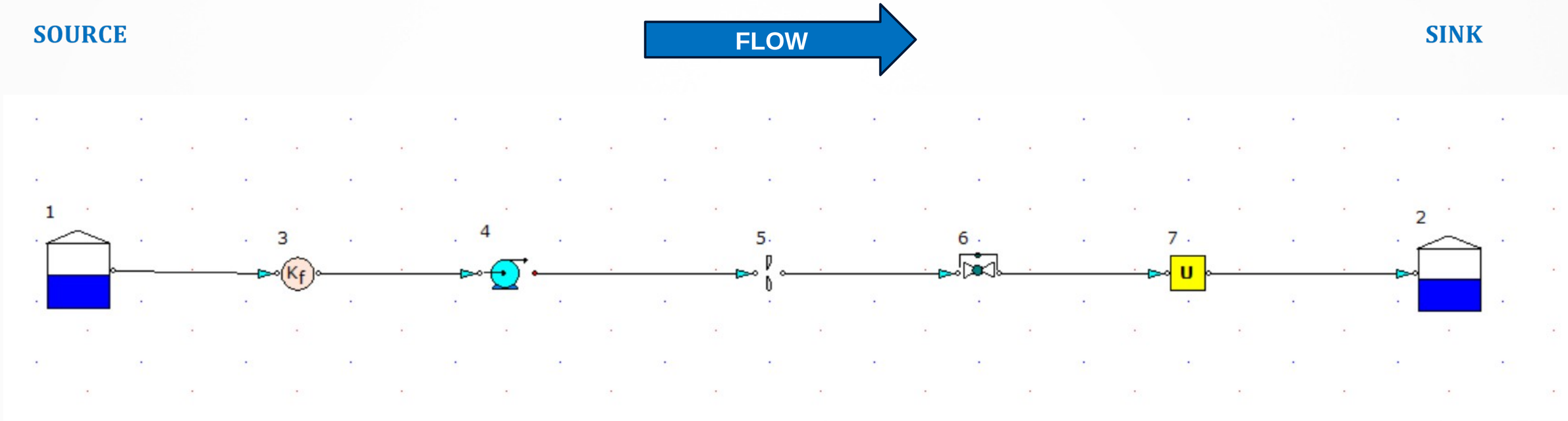
FluidFlow: Hydraulic Calculation Software Objectives

- To **ensure delivery of fluid** from source to sink



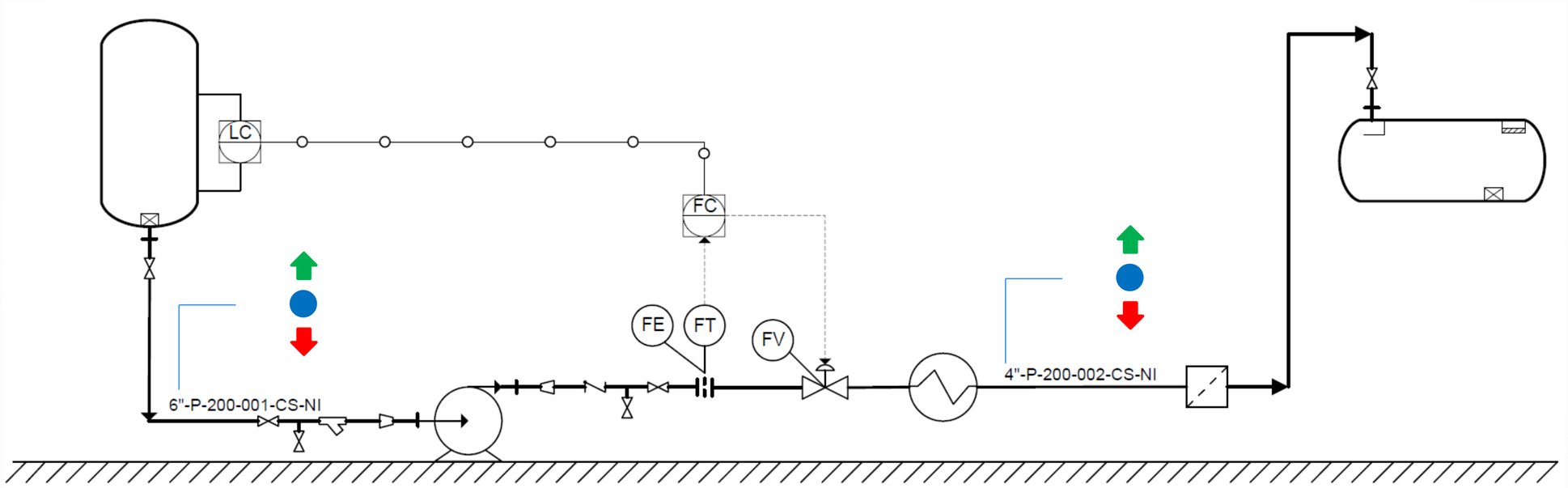
FluidFlow: Hydraulic Calculation Software Objectives

- To **ensure delivery of fluid** from source to sink



FluidFlow: Hydraulic Calculation Software Objectives

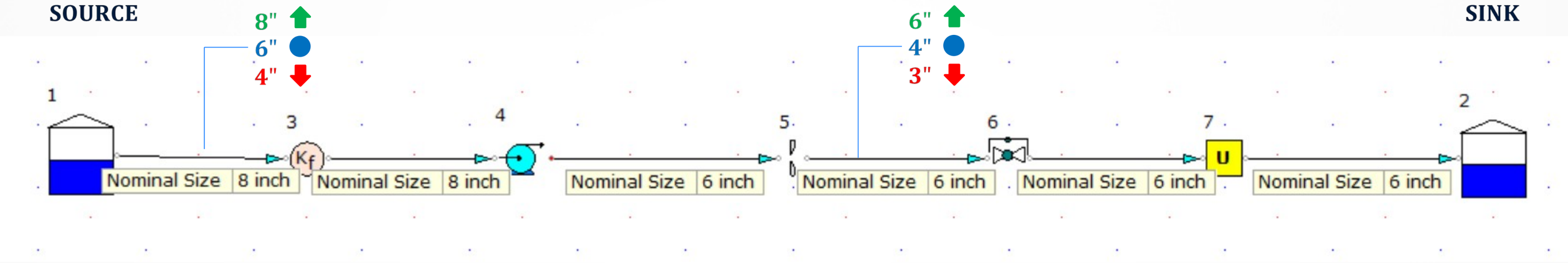
- To determine the **optimum line size**



FluidFlow: Hydraulic Calculation Software Objectives

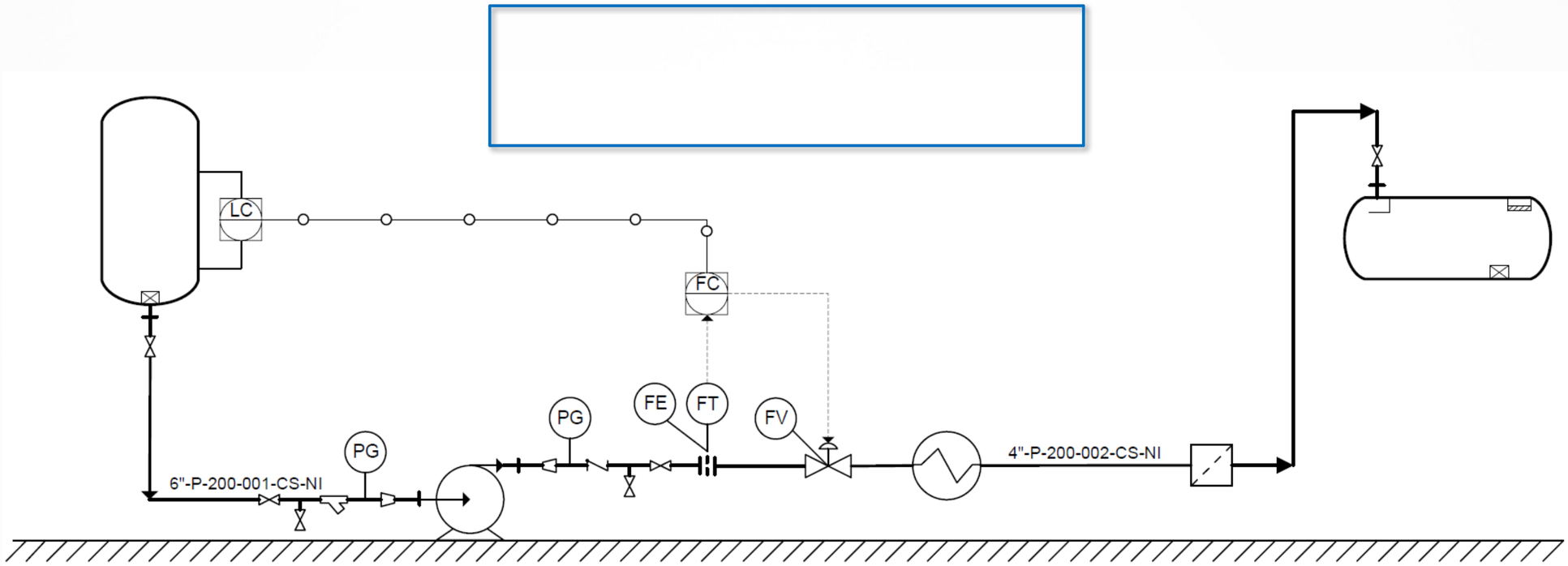
- To determine the **optimum line size**

Sizing Model	Economic Velocity
Heat Loss Model	Economic Velocity By Velocity By Pressure Gradient
User-Defined Fields	



FluidFlow: Hydraulic Calculation Software Objectives

- To determine the **pump head**

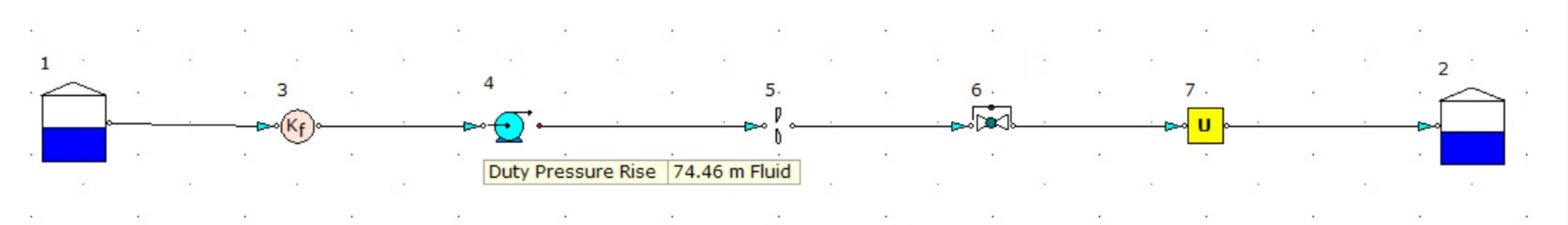


FluidFlow: Hydraulic Calculation Software Objectives

- To determine the **pump head**

$$\Delta H_{Pump} = \frac{\Delta P_{Pump}}{\rho \frac{g}{g_c}} = \frac{P_{discharge} - P_{suction}}{\rho \frac{g}{g_c}}$$

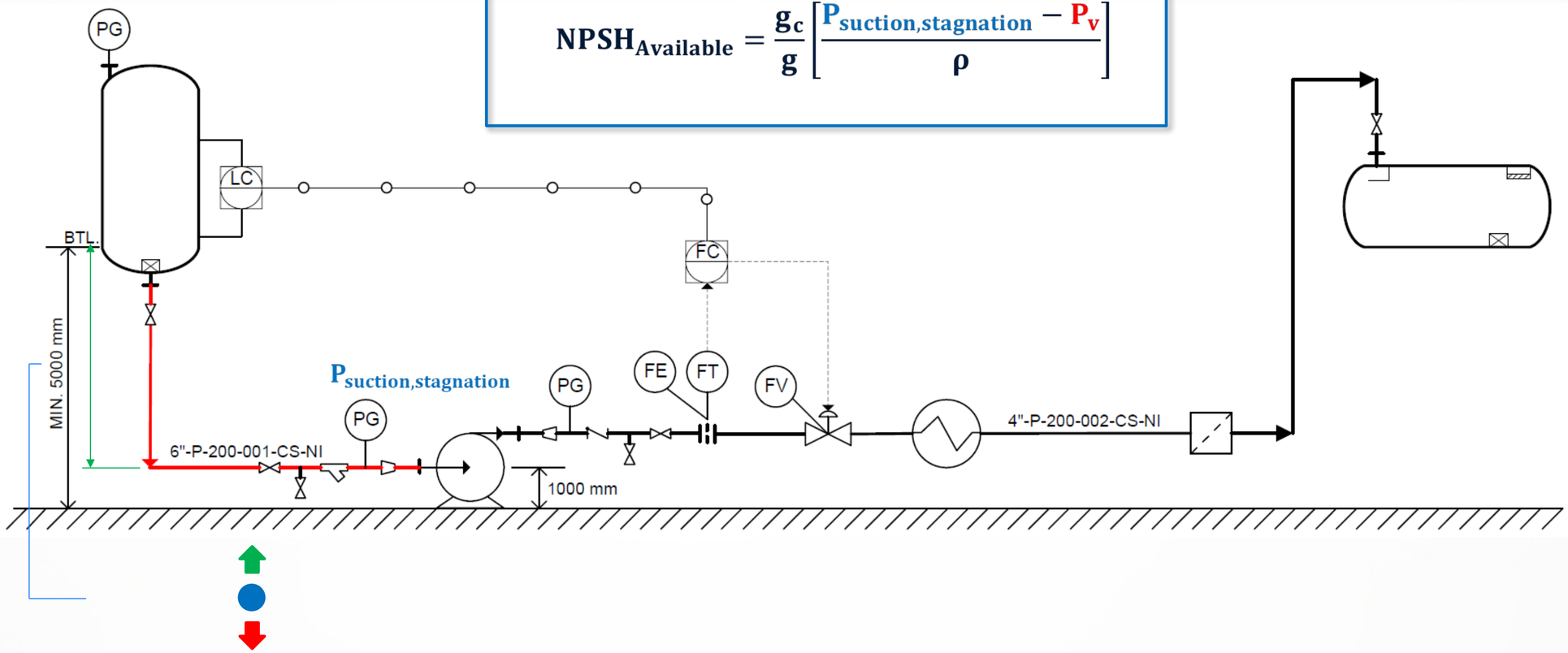
SOURCE **SINK**



FluidFlow: Hydraulic Calculation Software Objectives

- To determine the **pump suction vessel height** by checking the **pump NPSHA**

$$NPSH_{Available} = \frac{g_c}{g}\left[\frac{P_{suction,stagnation} - P_v}{\rho}\right]$$

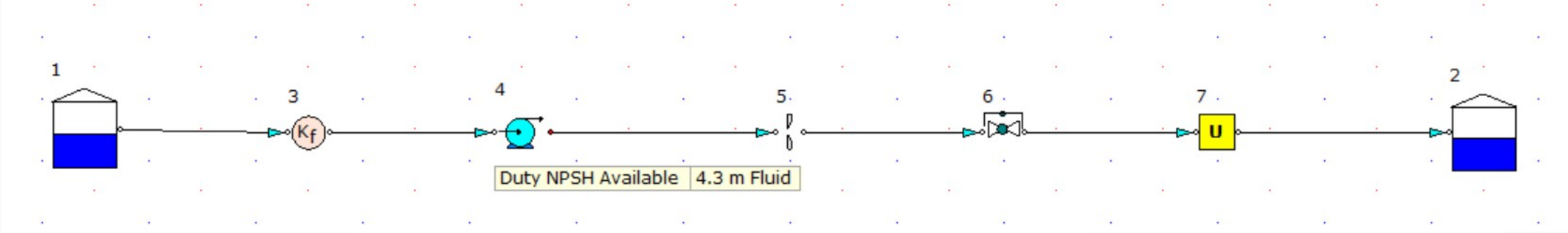


FluidFlow: Hydraulic Calculation Software Objectives

- To determine the **pump suction vessel height** by checking the **pump NPSHA**

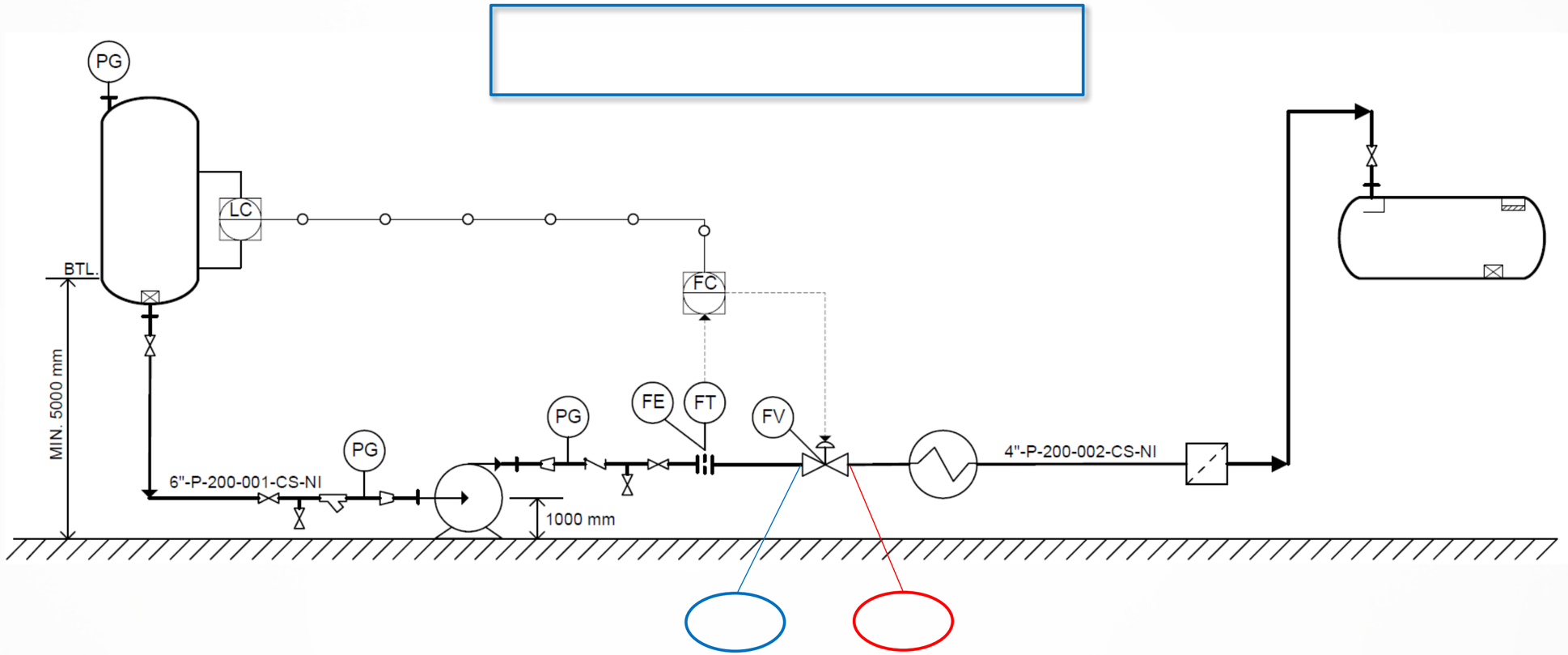
$$\mathbf{NPSH_{Available}} = \frac{g_c}{g}\left[\frac{P_{suction,stagnation} - P_v}{\rho}\right]$$

SOURCE **SINK**



FluidFlow: Hydraulic Calculation Software Objectives

- To calculate the **control valve pressure drop** and **calculate the Cv value.**

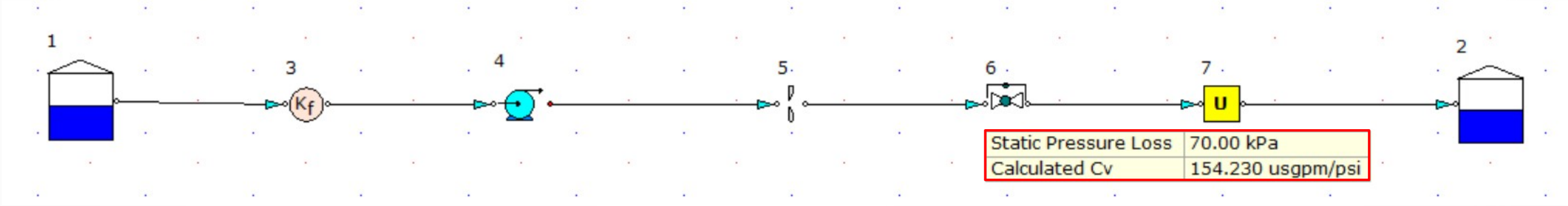


FluidFlow: Hydraulic Calculation Software Objectives

- To calculate the **control valve pressure drop** and **calculate the Cv value.**

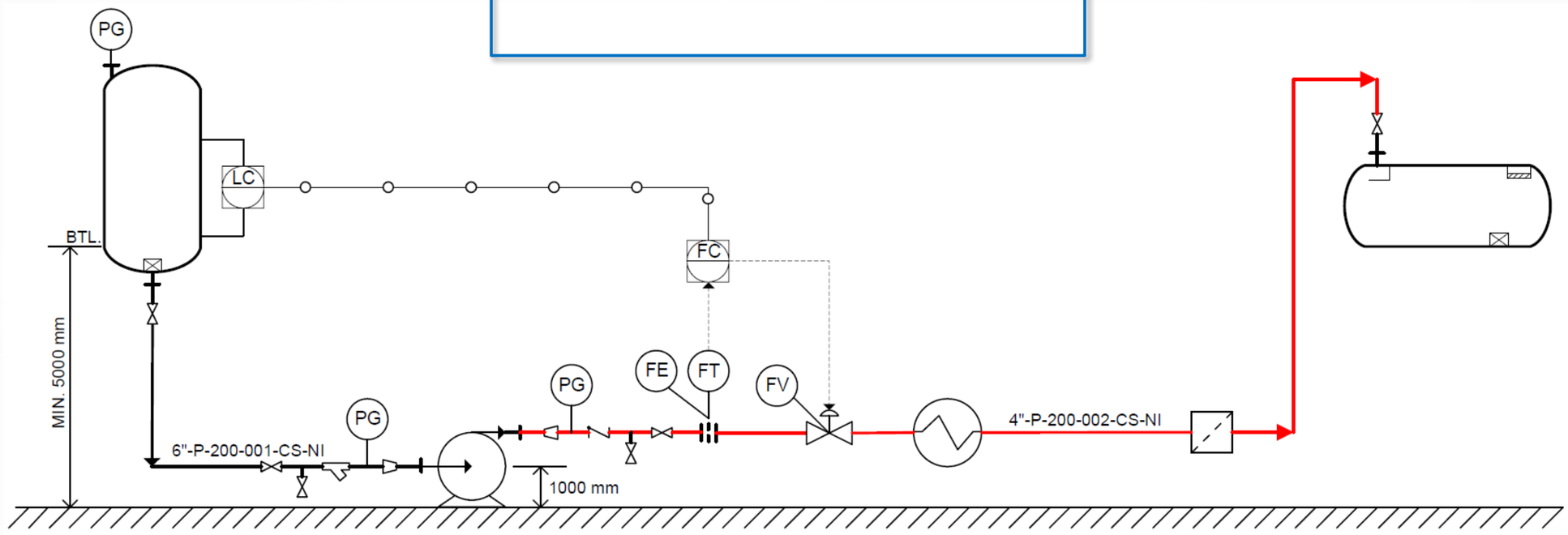
$$\Delta P_{\text{Control Valve}} = P_{\text{inlet}} - P_{\text{outlet}}$$

SOURCE **SINK**



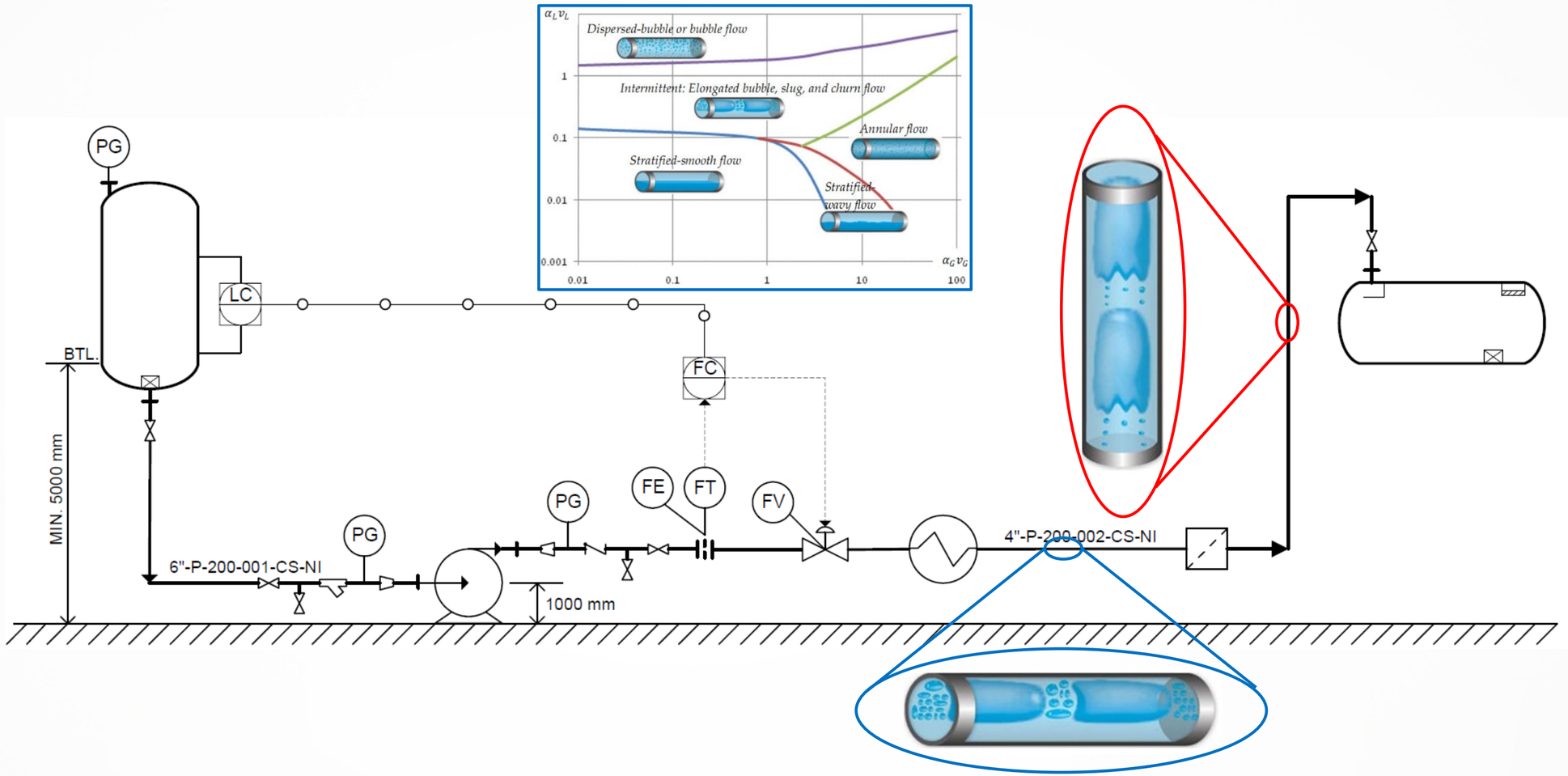
FluidFlow: Hydraulic Calculation Software Objectives

- To determine the **design pressure** in the pump discharge line/equipment



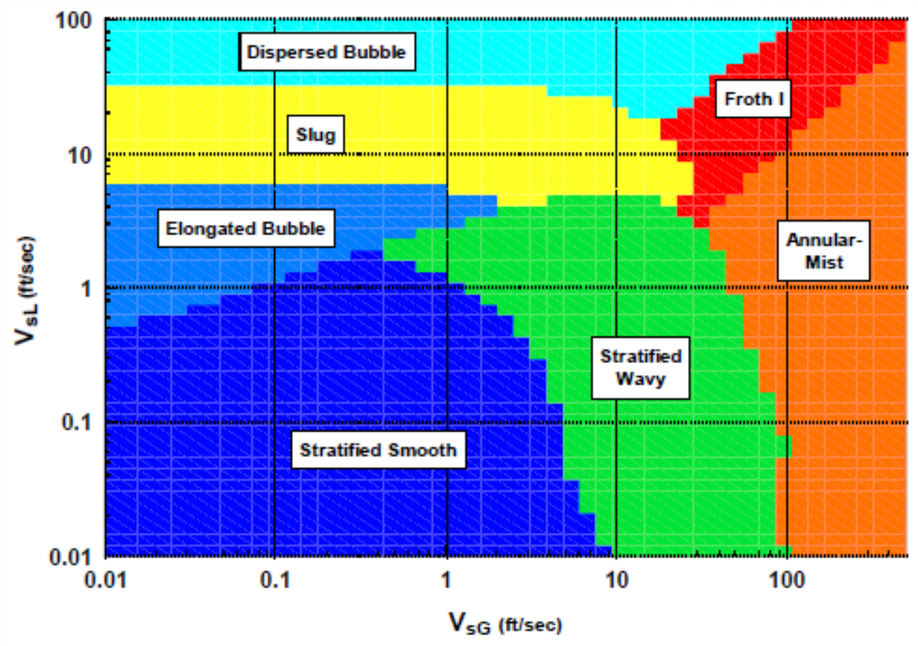
FluidFlow: Hydraulic Calculation Software Objectives

- To check the flow pattern (**for two-phase flow**)

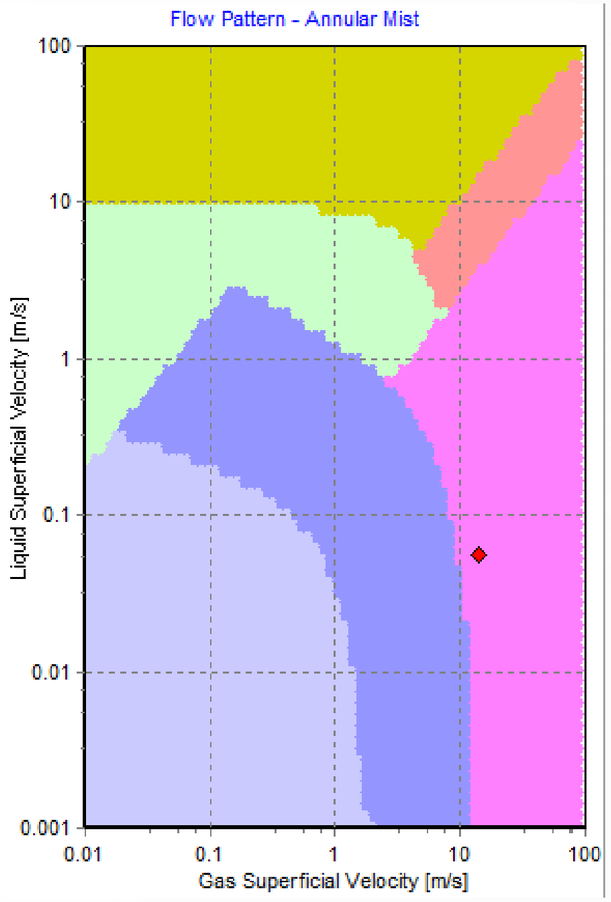


FluidFlow: Hydraulic Calculation Software Objectives

- To check the flow pattern (**for two-phase flow**)

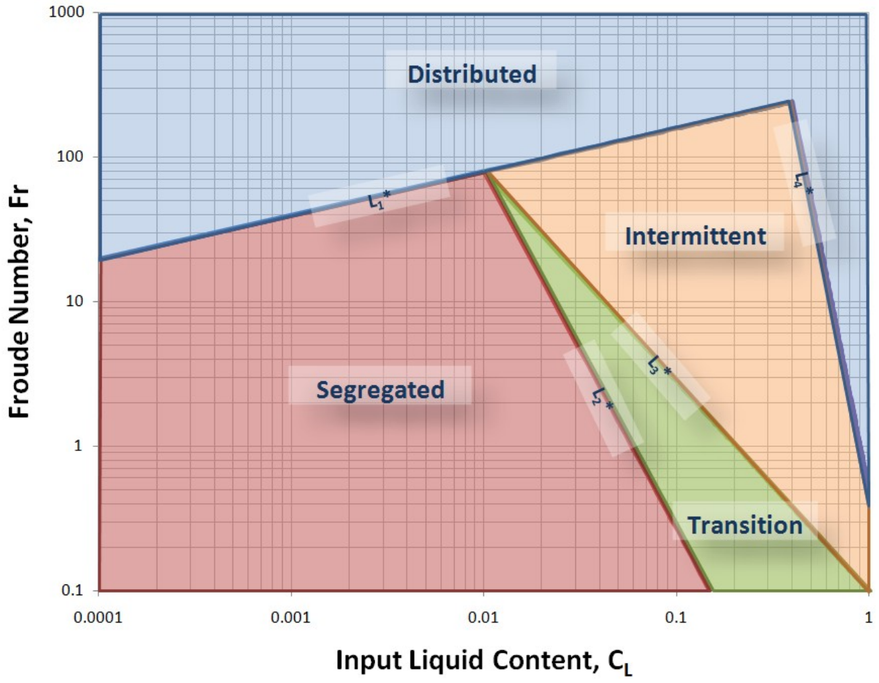


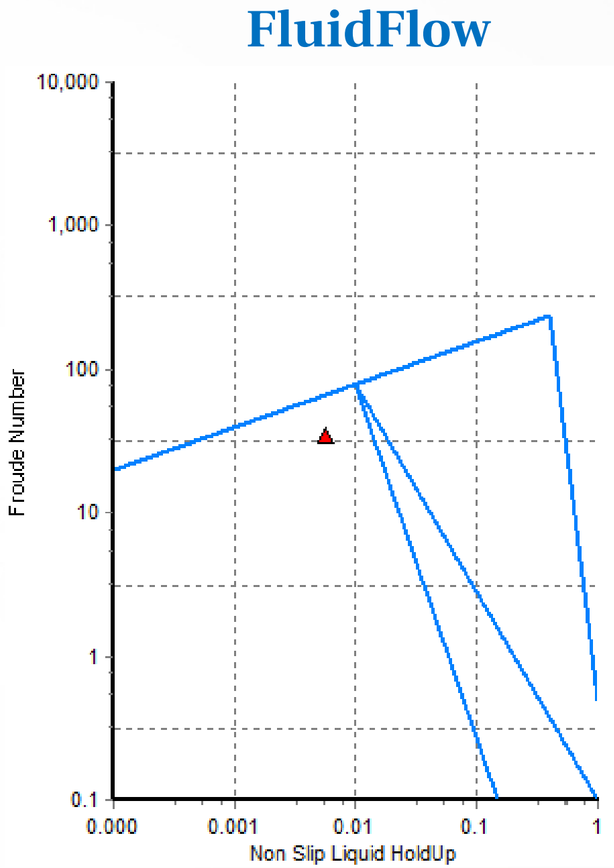
FluidFlow



FluidFlow: Hydraulic Calculation Software Objectives

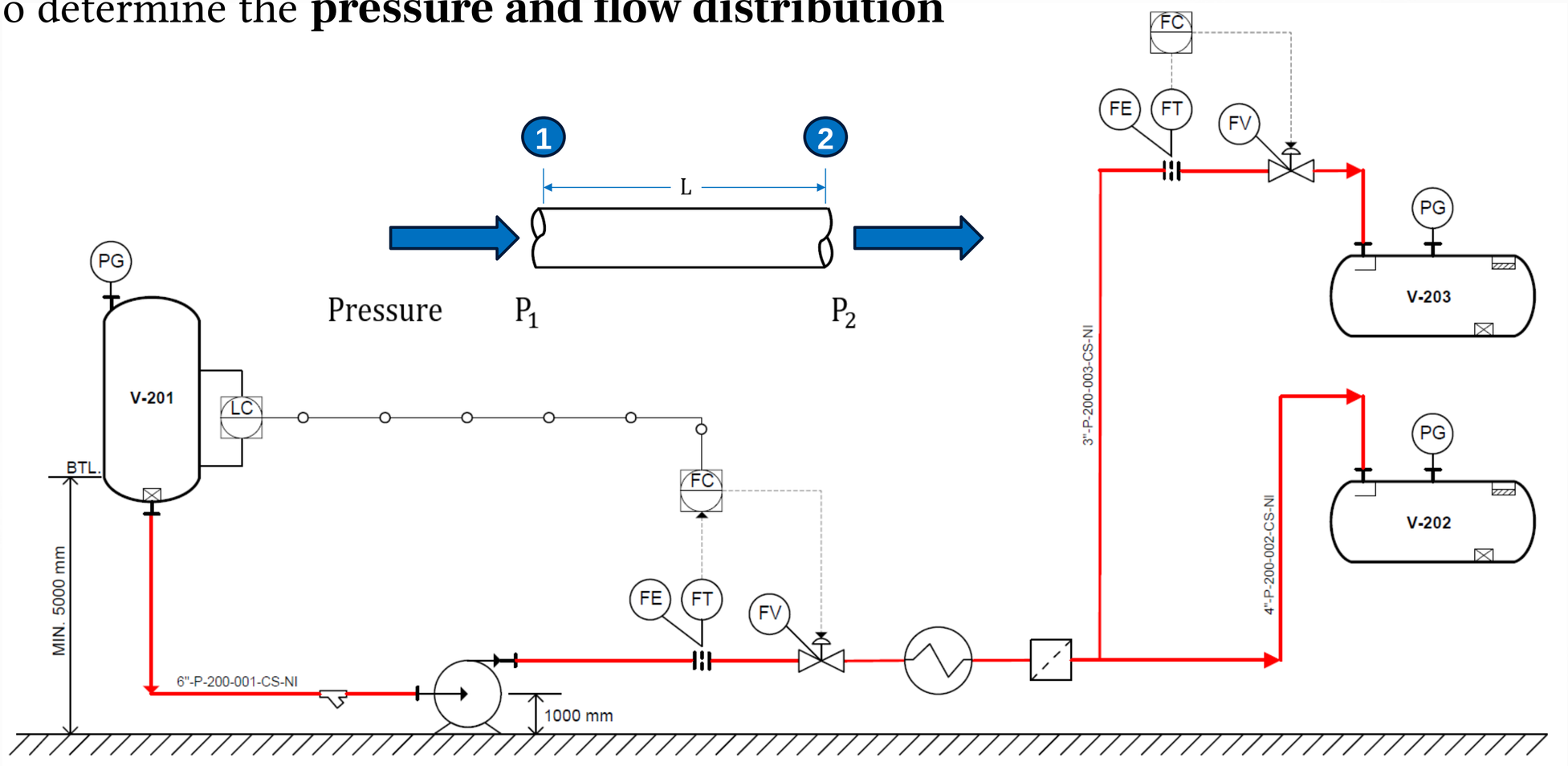
- To check the flow pattern (**for two-phase flow**)





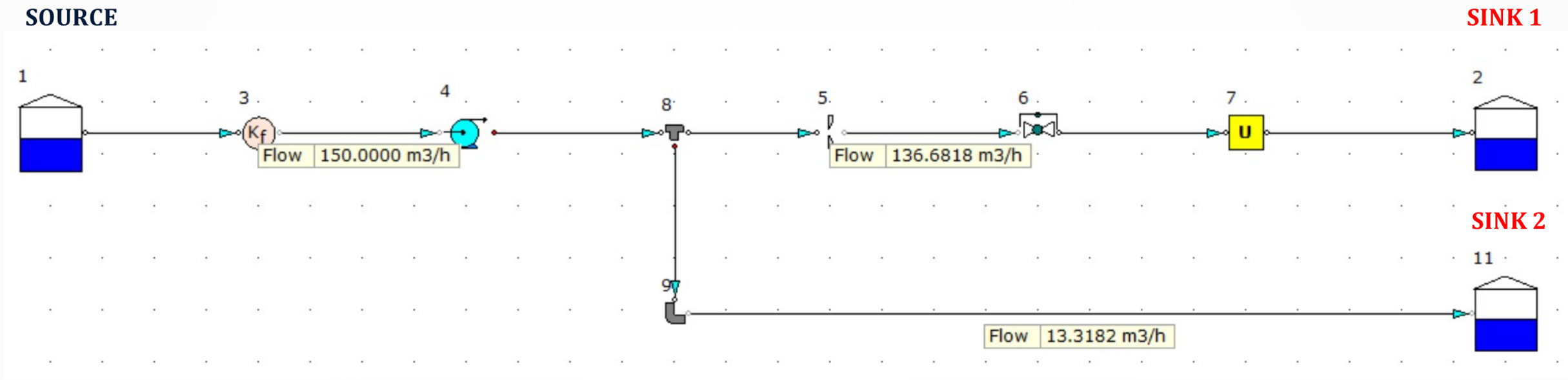
FluidFlow: Hydraulic Calculation Software Objectives

- To determine the **pressure and flow distribution**



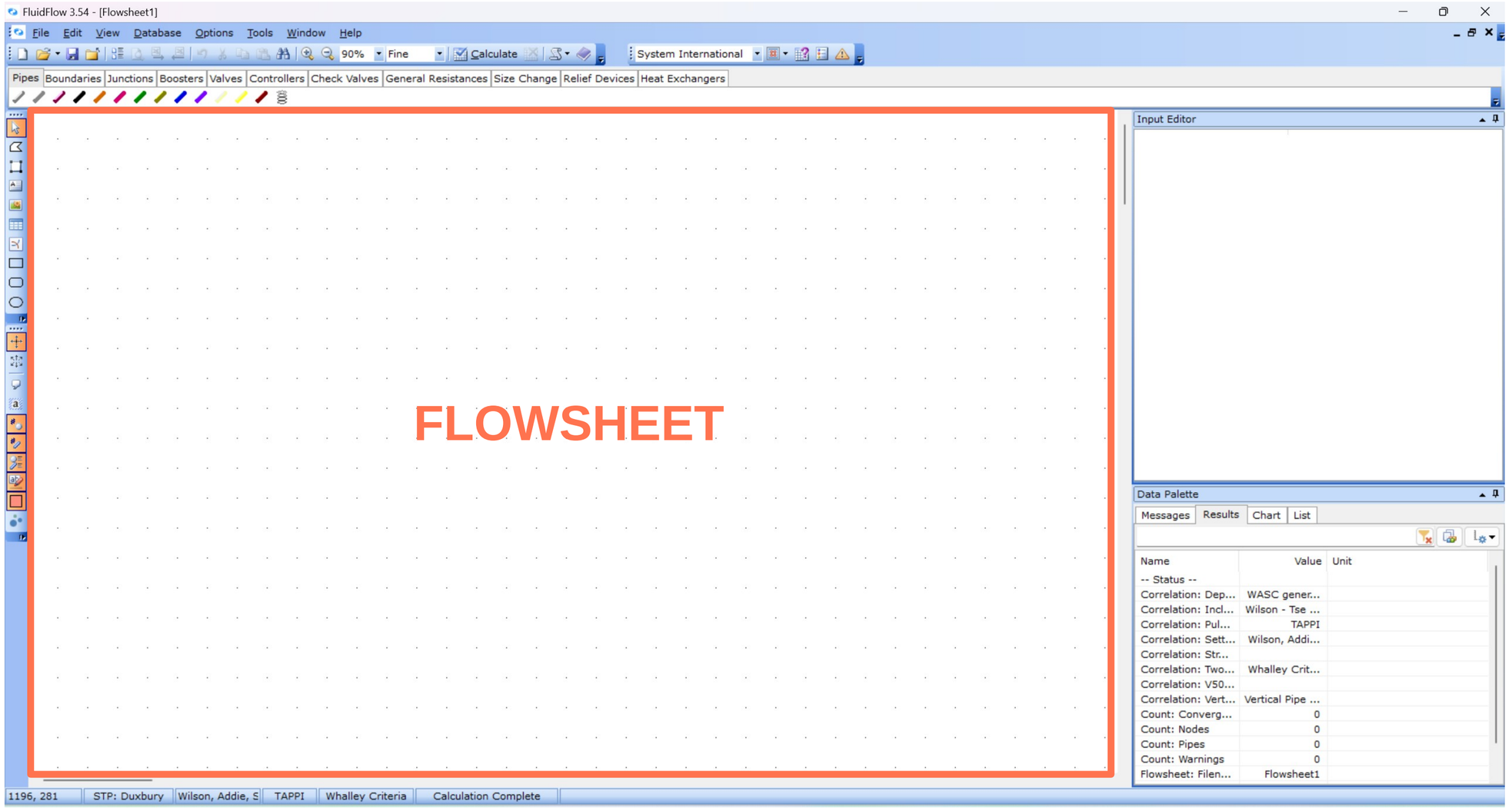
FluidFlow: Hydraulic Calculation Software Objectives

- To determine the **pressure and flow distribution**

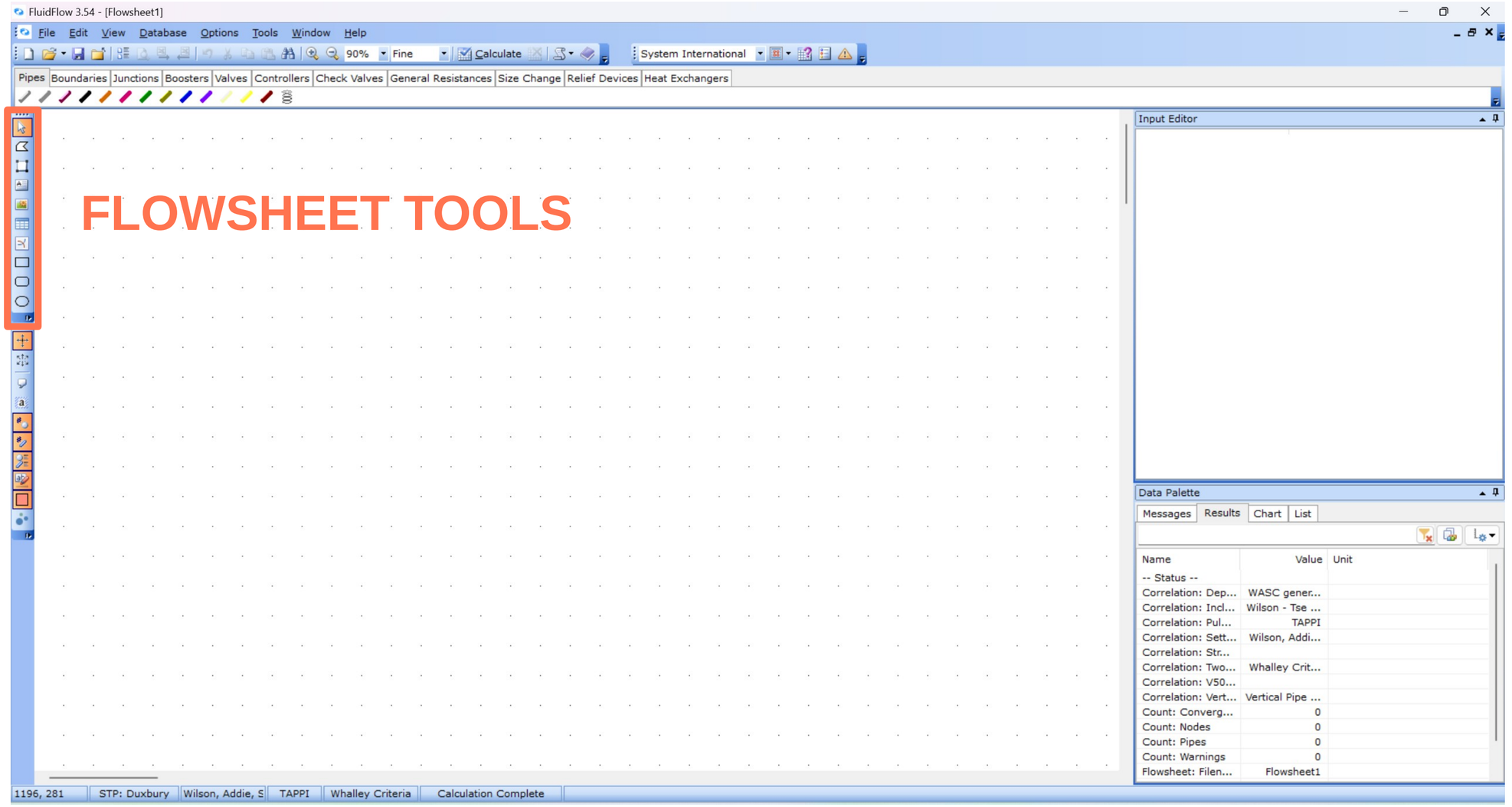


FLUIDFLOW USER INTERFACE

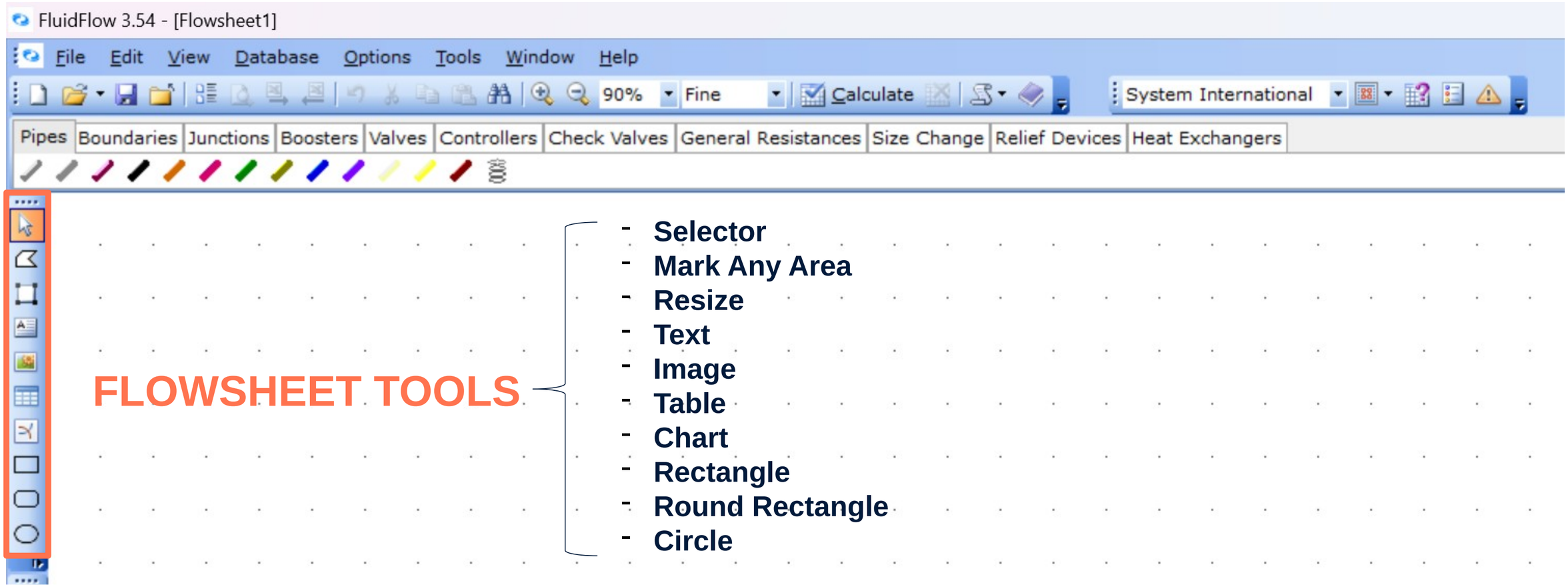
FluidFlow User Interface



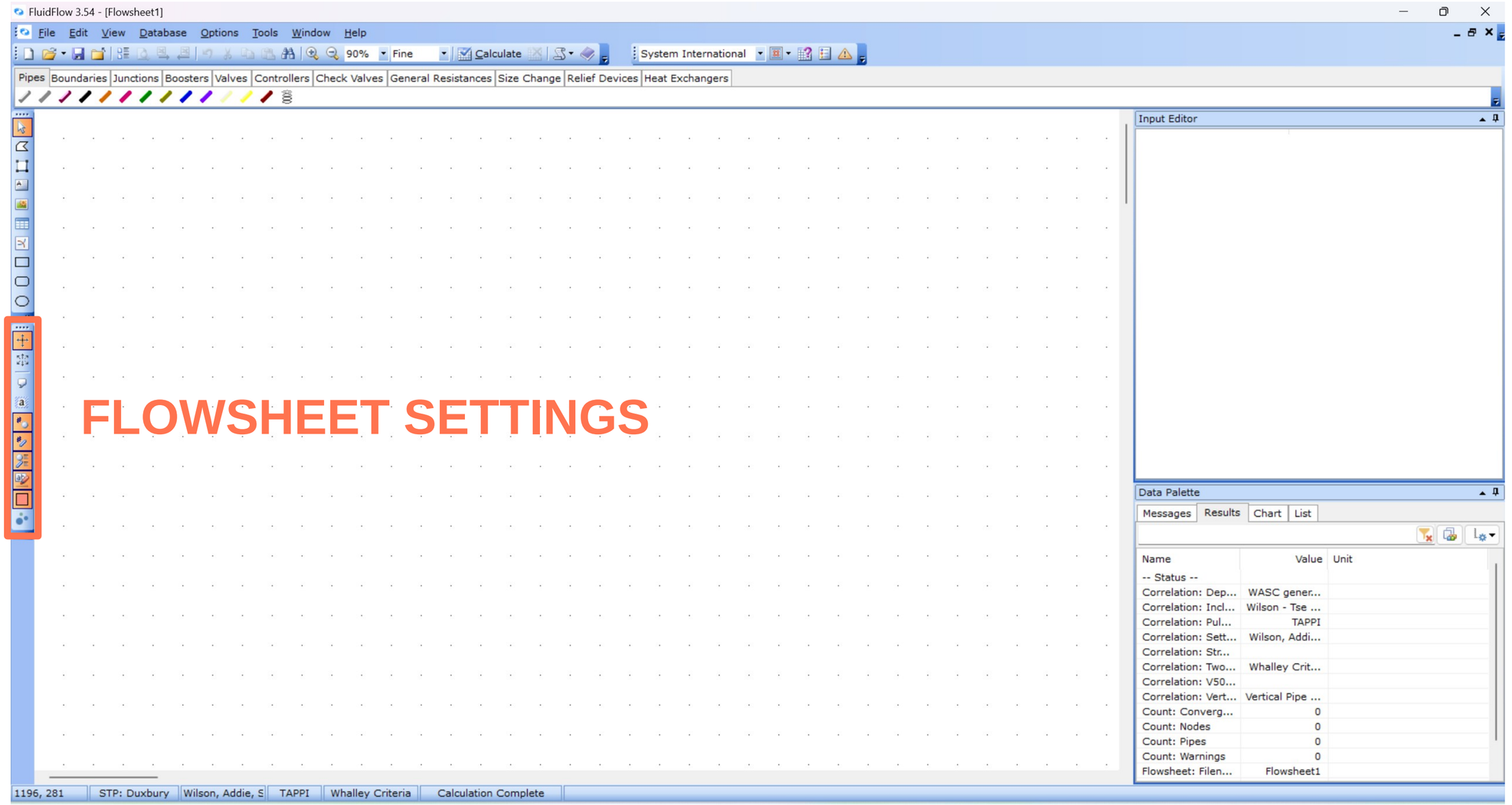
FluidFlow User Interface



FluidFlow User Interface



FluidFlow User Interface



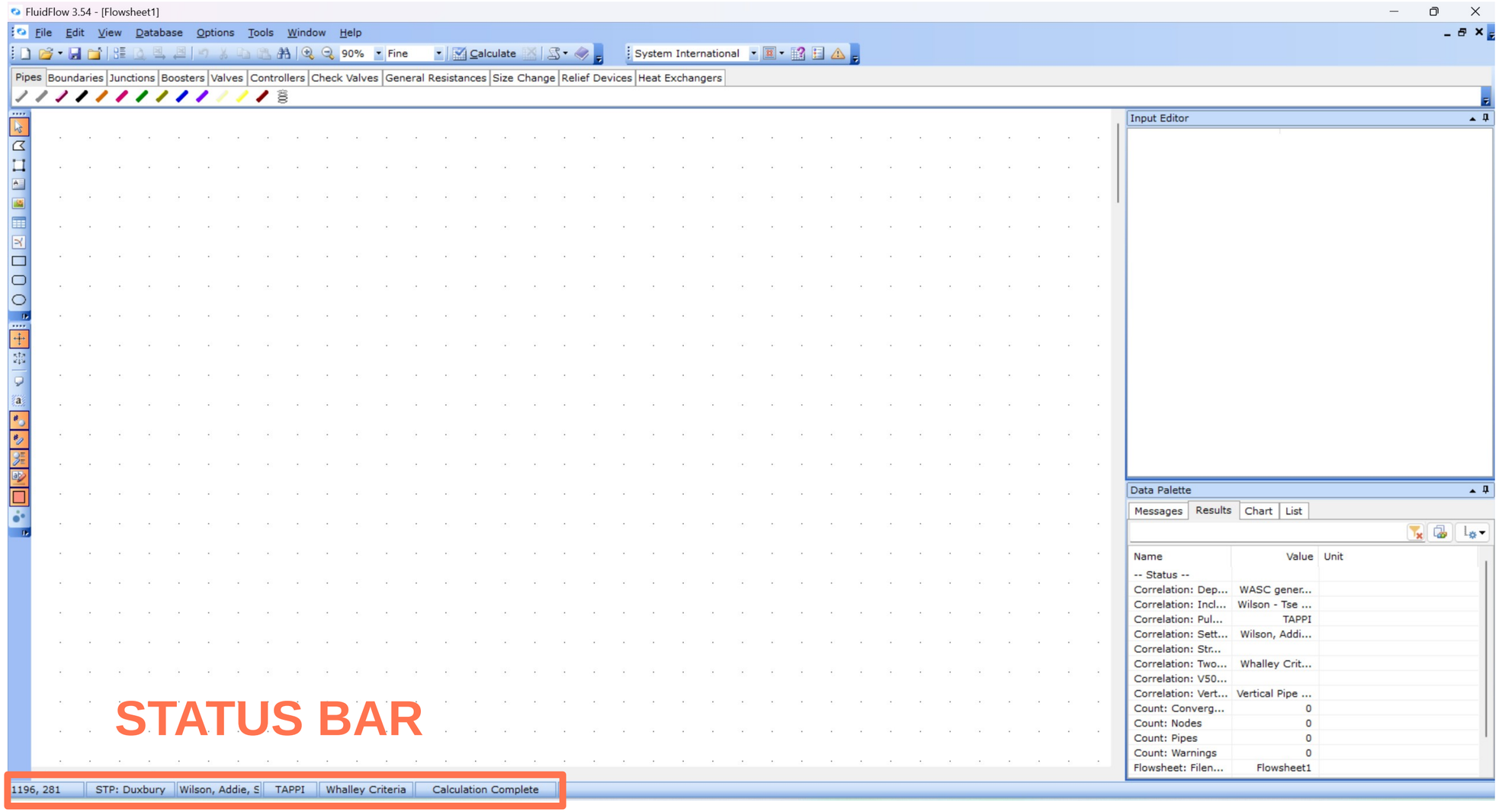
FluidFlow User Interface



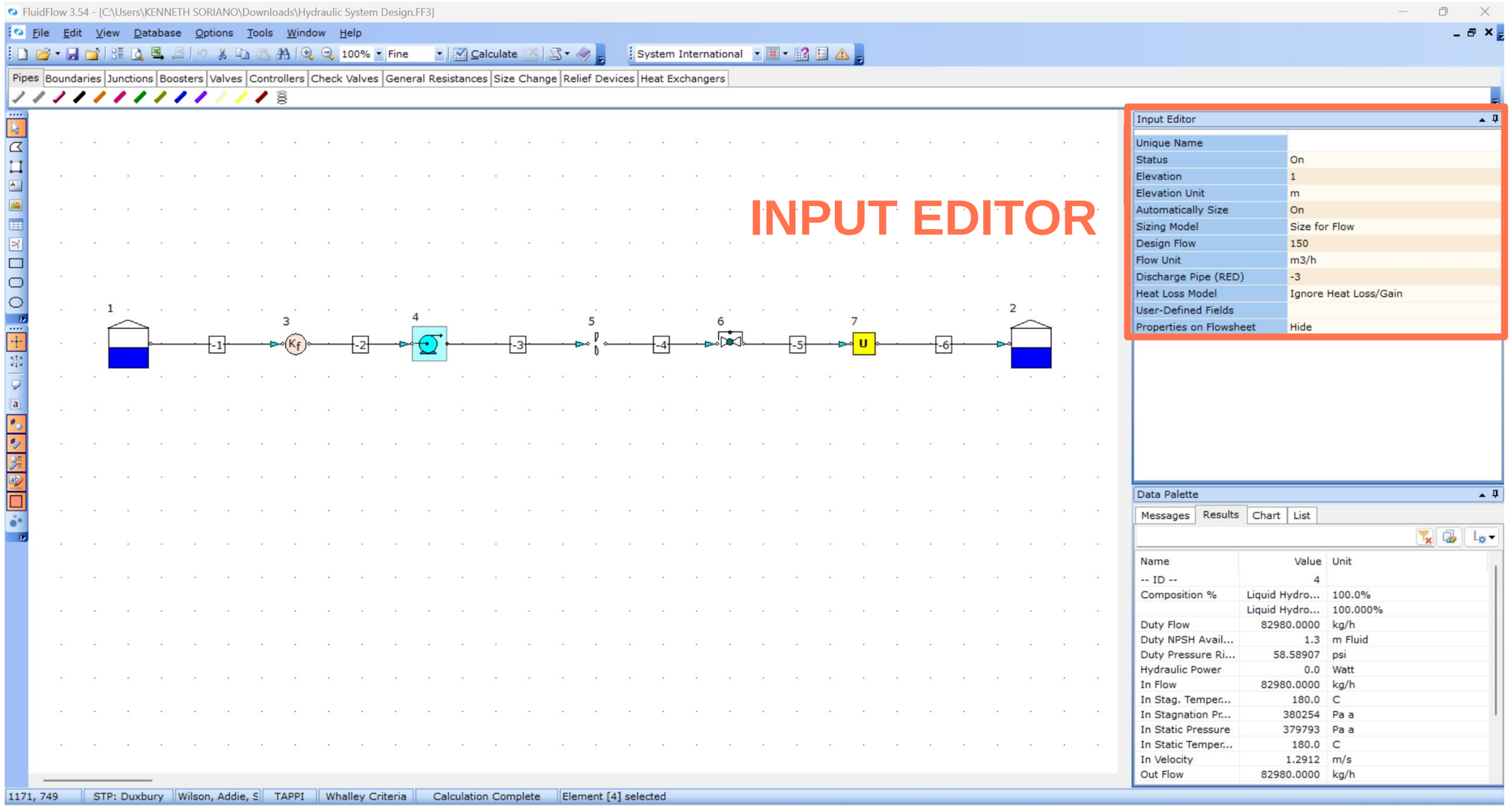
FLOWSHEET SETTINGS

- Orthogonal Cross-Hairs
- Isometric Cross-Hairs
- Show Flyby
- Show or Hide Node Numbers
- Show or Hide Pipe Numbers
- Show or Hide Properties on Flowsheet
- Show or Hide Text Objects
- Show or Hide Warning Highlight
- Use Minimized Node Icons

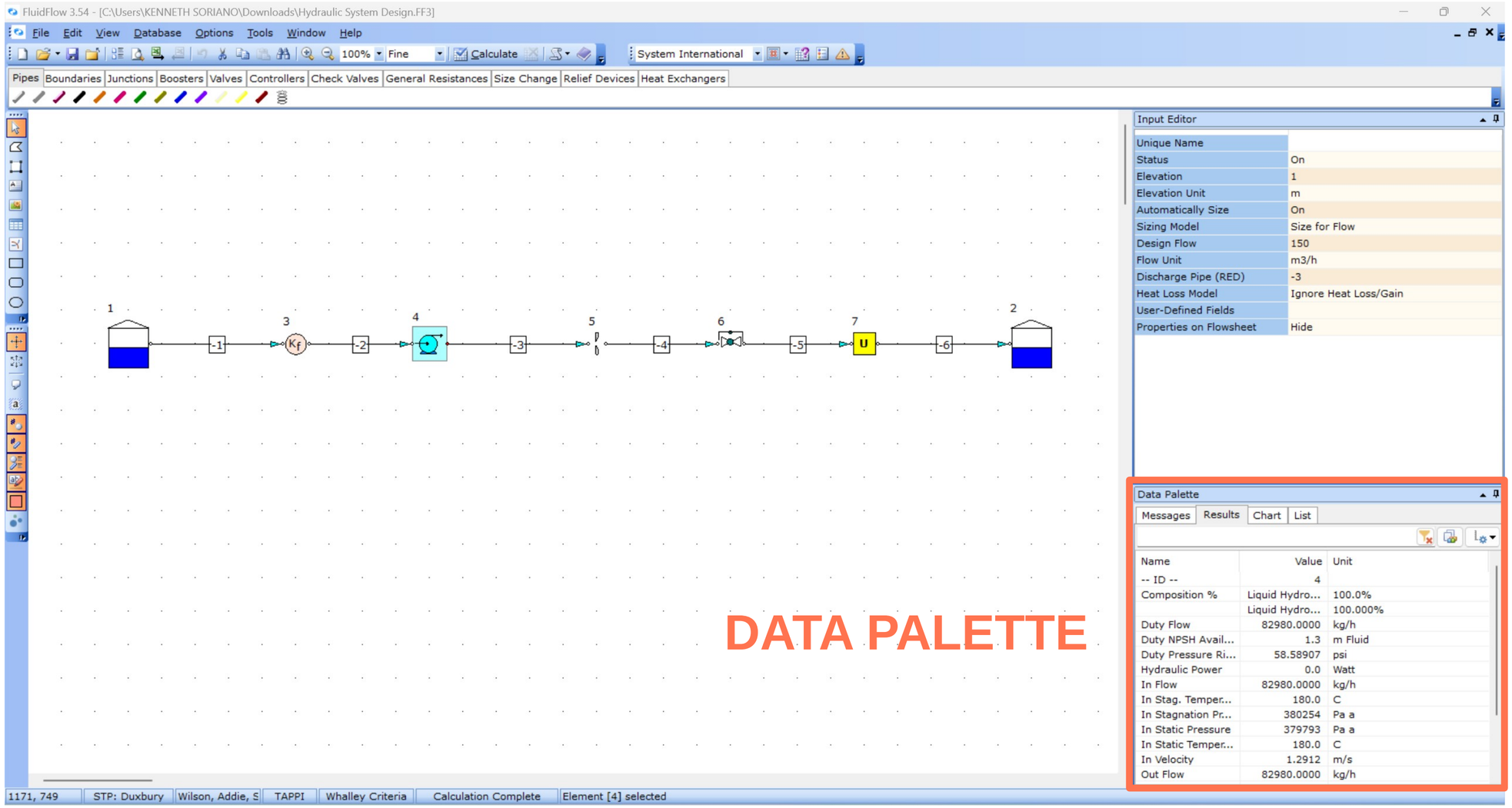
FluidFlow User Interface



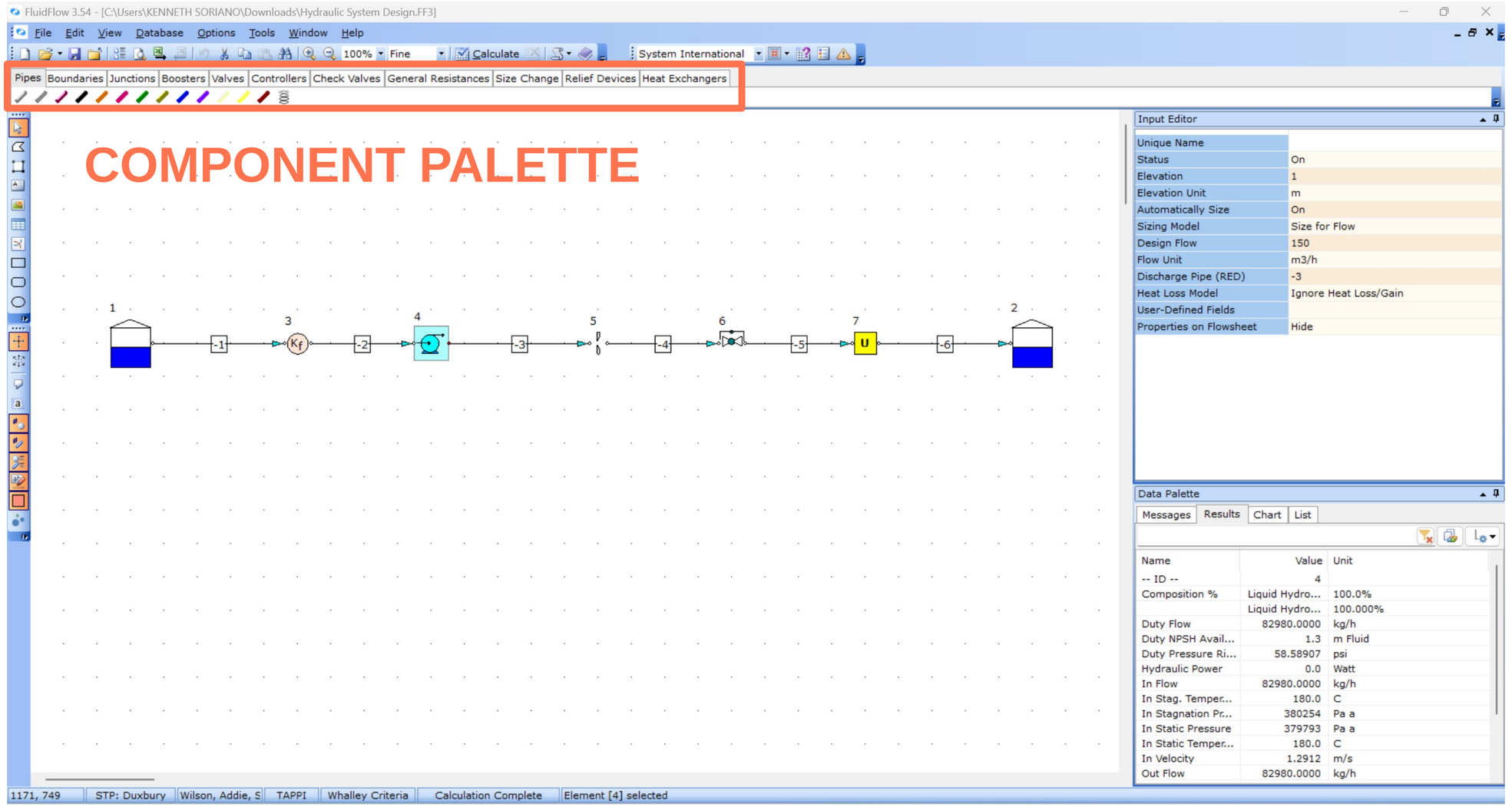
FluidFlow User Interface



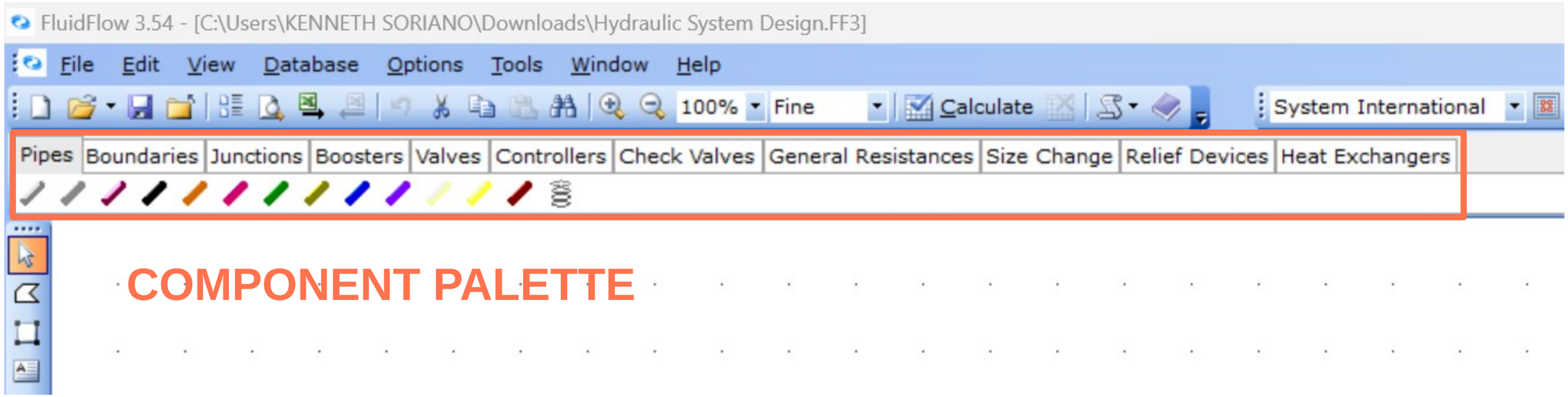
FluidFlow User Interface



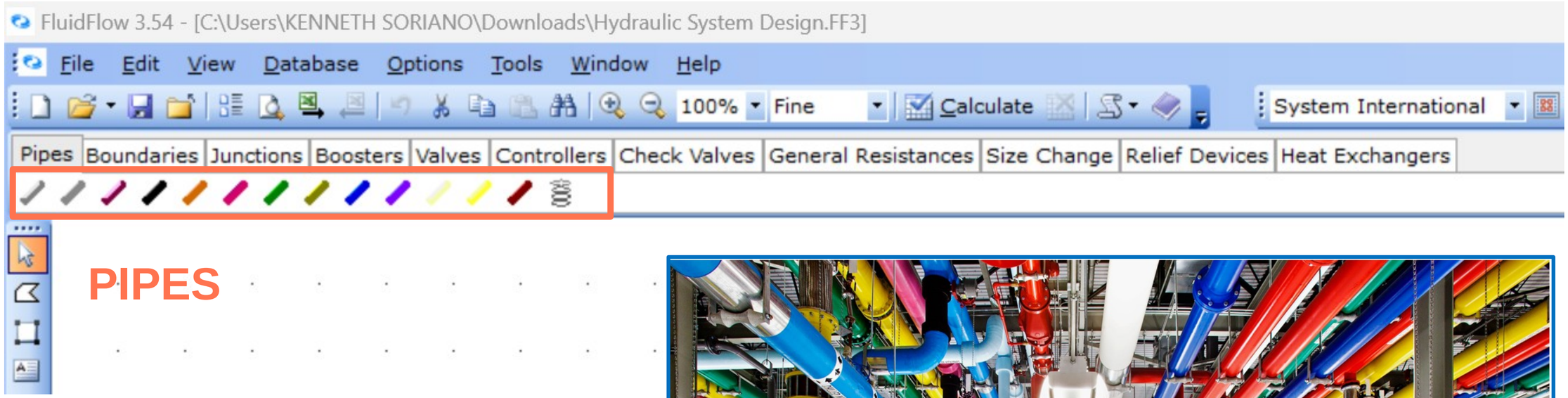
FluidFlow User Interface



FluidFlow User Interface



FluidFlow User Interface



PIPES

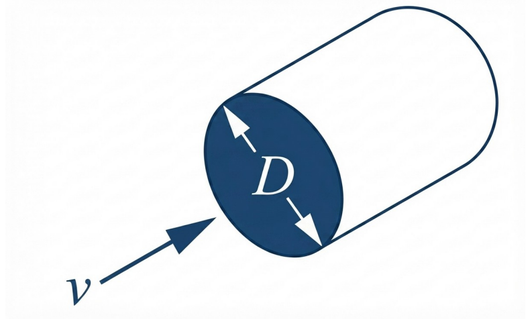
- Steel Pipe or Duct (Carbon Steel)
- Stainless Steel Pipe or Duct
- Ductile Iron Pipe
- Cast Iron Pipe
- Copper Pipe
- Aluminum Pipe or Duct
- ABS Pipe
- PVC Pipe or Duct
- PE Pipe or Duct
- PP or PFA Pipe or Duct
- Glass Pipe
- Concrete Pipe
- Asbestos Cement Pipe
- Flexible Smooth or Corrugated Hose

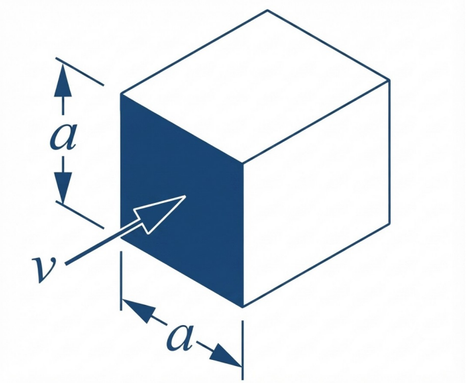
FluidFlow User Interface

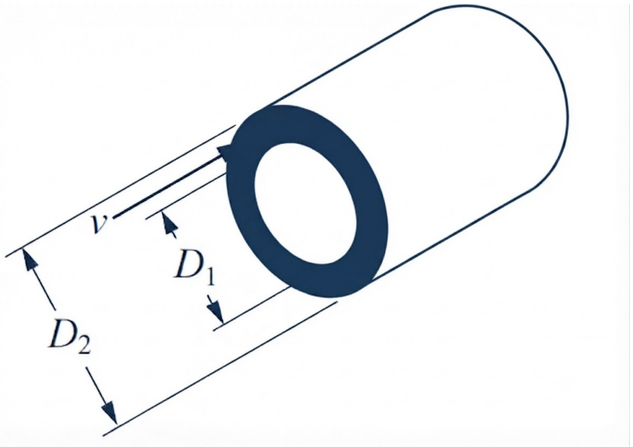
PIPES/DUCTS

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Unique Name	
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Length Unit	m
Geometry	Cylindrical
Use Database Size	Cylindrical / Rectangular/Square / Annulus
Nominal Size	
Classification	Schedule 40
Friction Model	Moody
Use Database Roughness	Yes
Roughness Description	Clean or new
Use Database Scaling	No
Scaling (0 to 50%)	0
Sizing Model	Economic Velocity
Heat Loss Model	Ignore Heat Loss/Gain
User-Defined Fields	

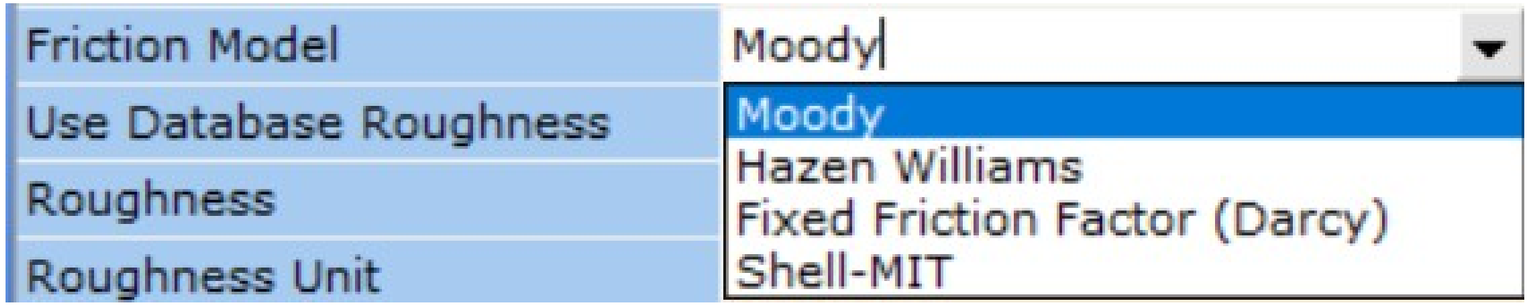




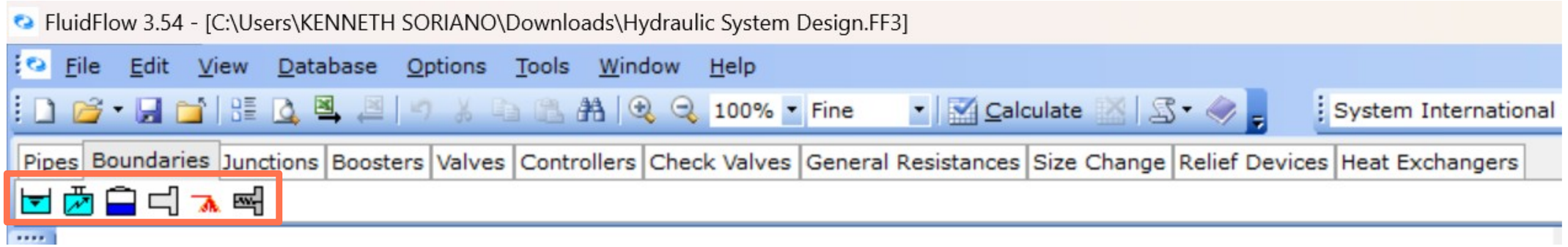


FluidFlow User Interface

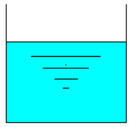
PIPES/DUCTS



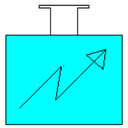
FluidFlow User Interface



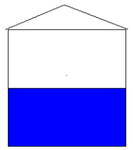
BOUNDARIES



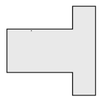
Known or Assigned Pressure



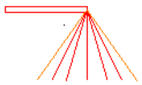
Known or Assigned Flow



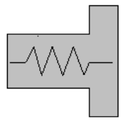
Reservoir / Accumulator / Vessel



Open Pipe

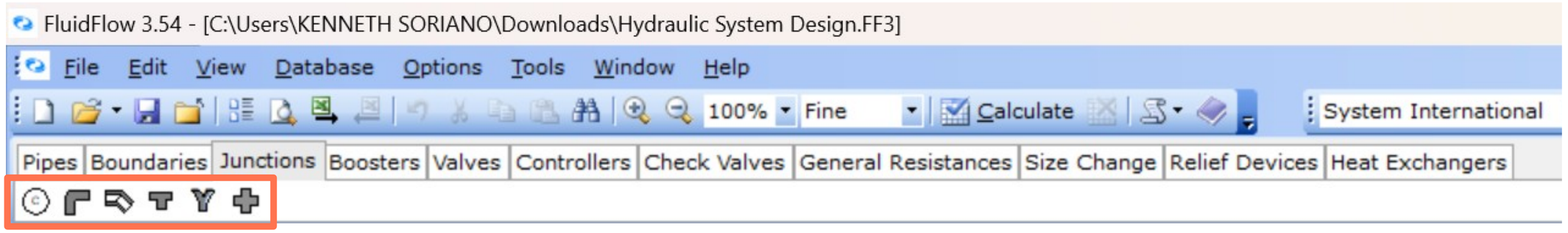


Sprinkler

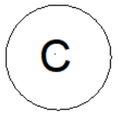


Known Resistance

FluidFlow User Interface



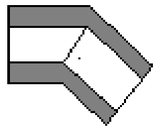
JUNCTIONS



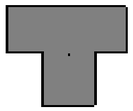
Connector (No Resistance)



Bend



Mitre Bend



Tee Junction



Symmetric Wye



Cross Junction

FluidFlow User Interface

JUNCTIONS

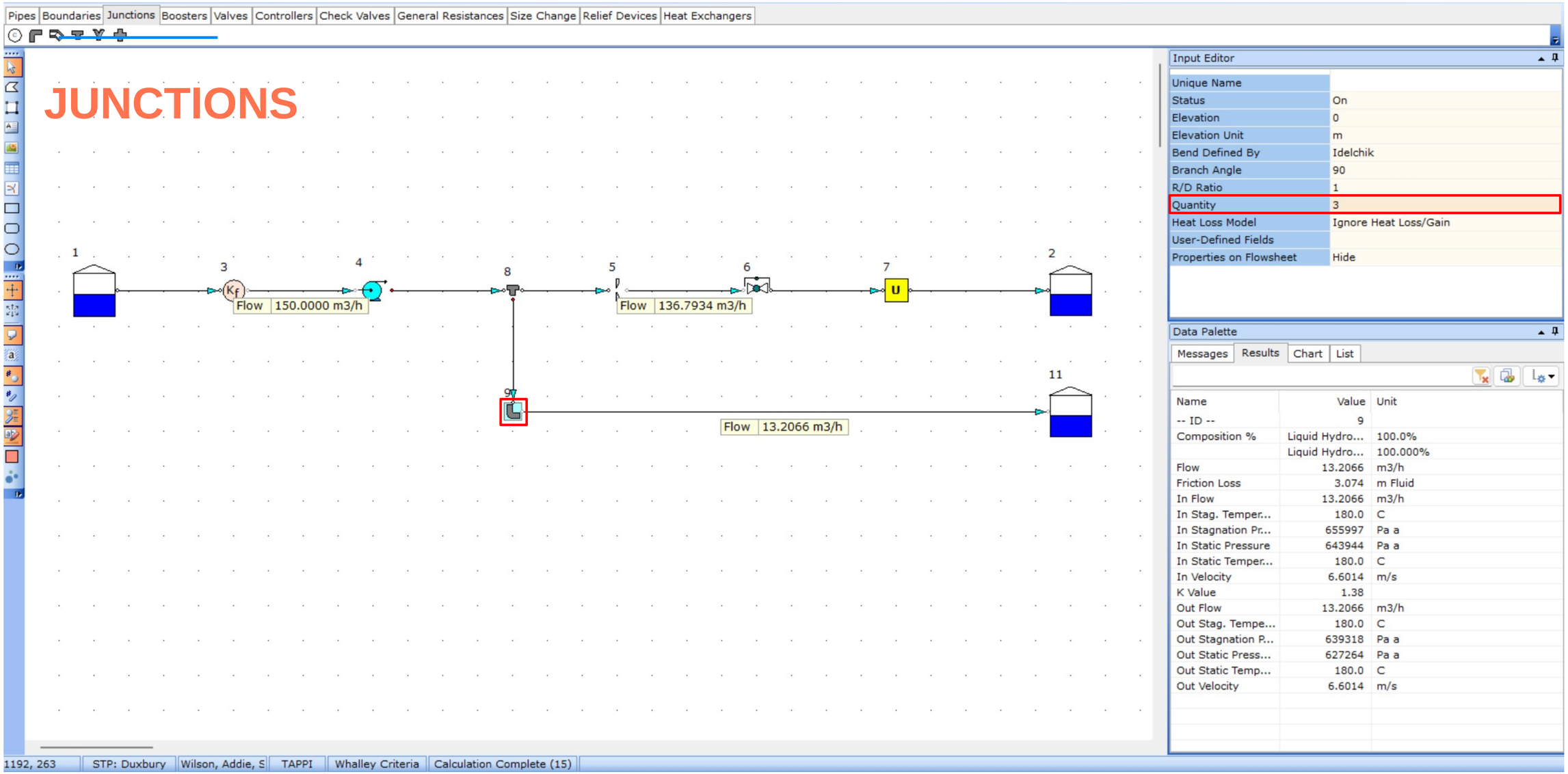


Bend

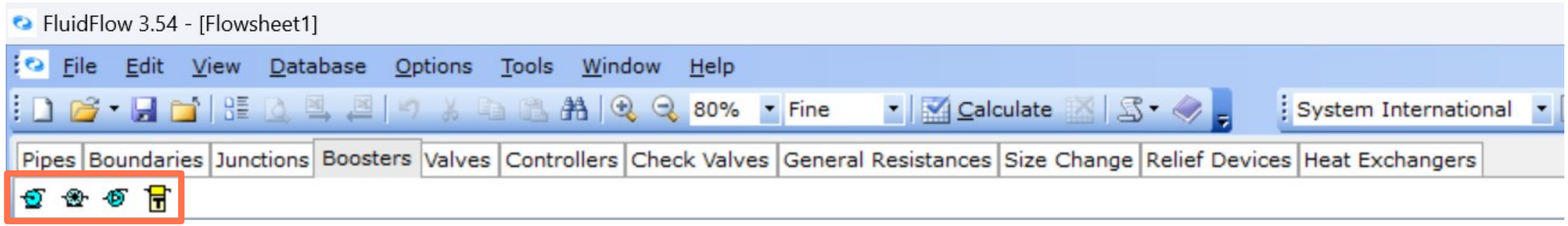
Input Editor

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Elevation Unit	m
Bend Defined By	Idelchik
Branch Angle	90
R/D Ratio	1
Quantity	5
Heat Loss Model	Ignore Heat Loss/Gain
User-Defined Fields	
Properties on Flowsheet	Hide

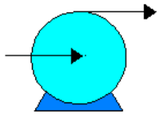
FluidFlow User Interface



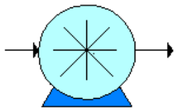
FluidFlow User Interface



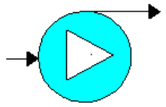
BOOSTERS



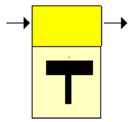
Centrifugal Pump



Rotating Positive Displacement Pump



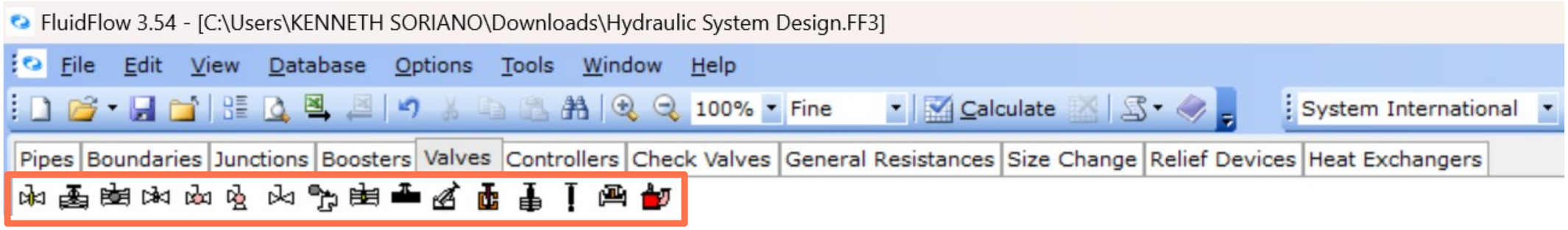
Fan or Compressor



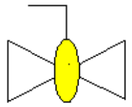
Positive Displacement Pump or Compressor

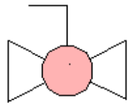


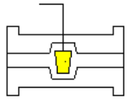
FluidFlow User Interface

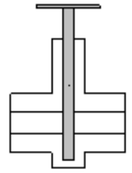


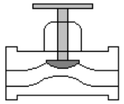
VALVES

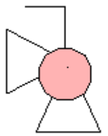

Butterfly Valve

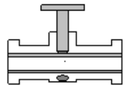

Globe Valve


Plug Valve

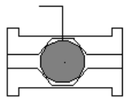

Slide Valve

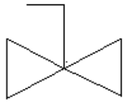

Diaphragm Valve

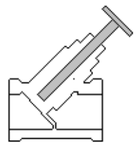

Angle Valve

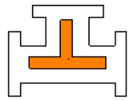

Pinch Valve

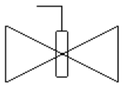

Penstock

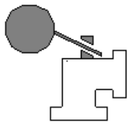

Ball Valve

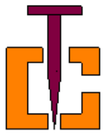

V2 Unspecified

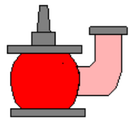

Y Globe Valve


3-Way Valve

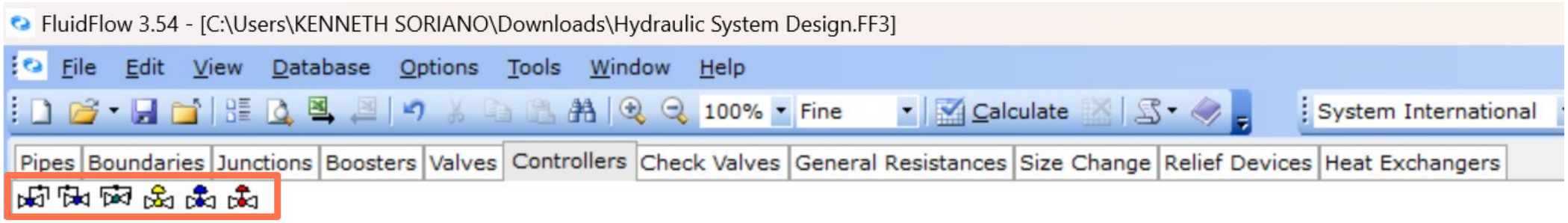

Gate Valve


Ball Float Valve

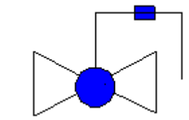

Needle Valve


Fire Hydrant

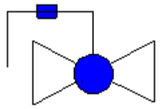
FluidFlow User Interface



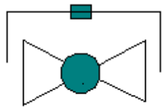
CONTROL VALVES (CONTROLLERS)



Self-Acting Pressure Reducer



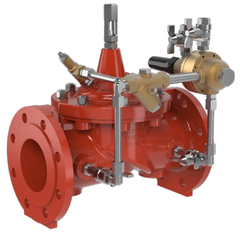
Self-Acting Pressure Sustainer



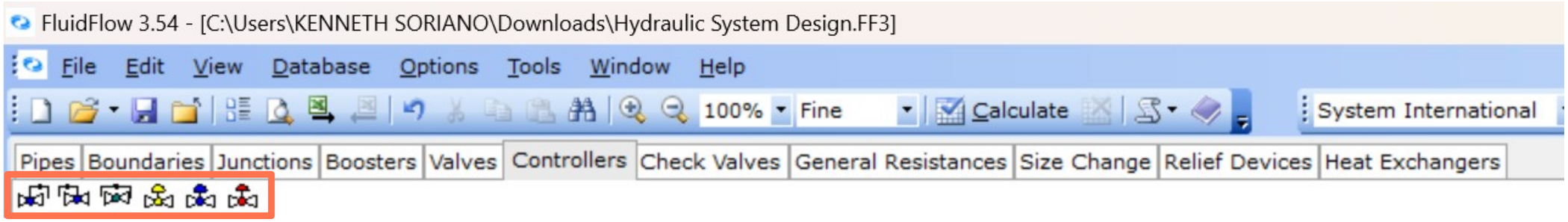
Self-Acting Diff. Pressure Control Valve



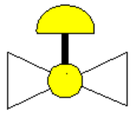




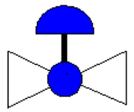
FluidFlow User Interface



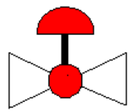
CONTROL VALVES (CONTROLLERS)



Flow Control Valve



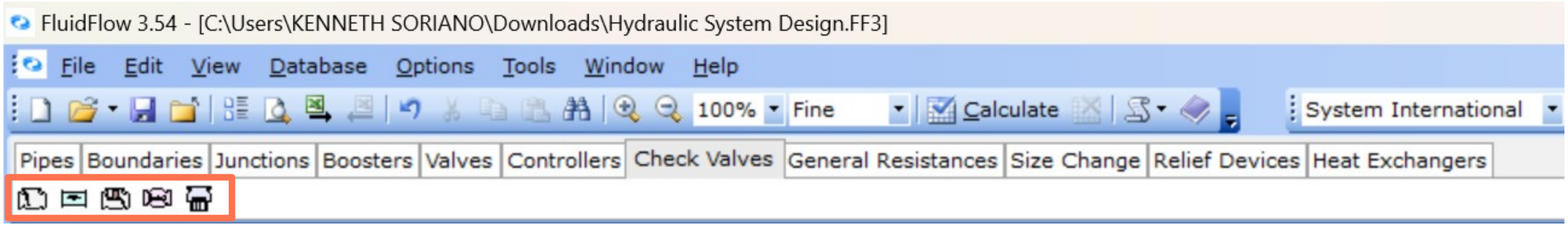
Pressure Control Valve



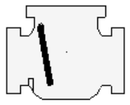
Gas Regulator



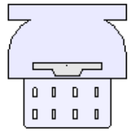
FluidFlow User Interface



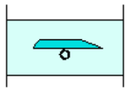
CHECK VALVES



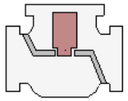
Swing Check Valve



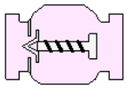
Foot-Operated Check Valve



Tilting Disk Check Valve

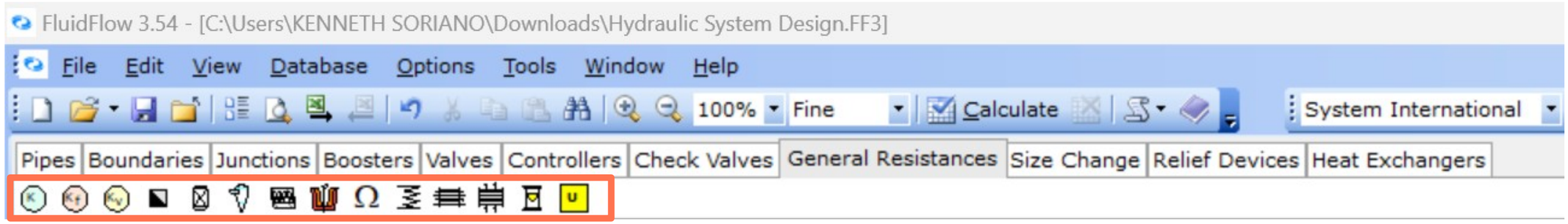


Piston-Operated Check Valve



Spring-Loaded Check Valve

FluidFlow User Interface



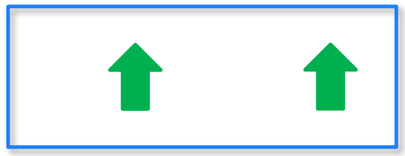
GENERAL RESISTANCES

- K [Pressure Loss Coefficient]
- Kf [Equivalent Length (L/D)]
- Kv / Cv [Flow Coefficient]
- Inline Filter
- Packed Bed
- Cyclone
- Labyrinth Seal
- Centrifuge

FluidFlow User Interface

GENERAL RESISTANCES

K **K [Pressure Loss Coefficient]**

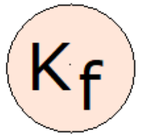


Input Editor

Unique Name	
Status	On
Elevation	0
Elevation Unit	m
Use K from Database	No
K (Pressure Loss Coeff)	5
Quantity	1
Loss Basis	Upstream Velocity
Heat Loss Model	Ignore Heat Loss/Gain
User-Defined Fields	
Properties on Flowsheet	Hide

FluidFlow User Interface

GENERAL RESISTANCES

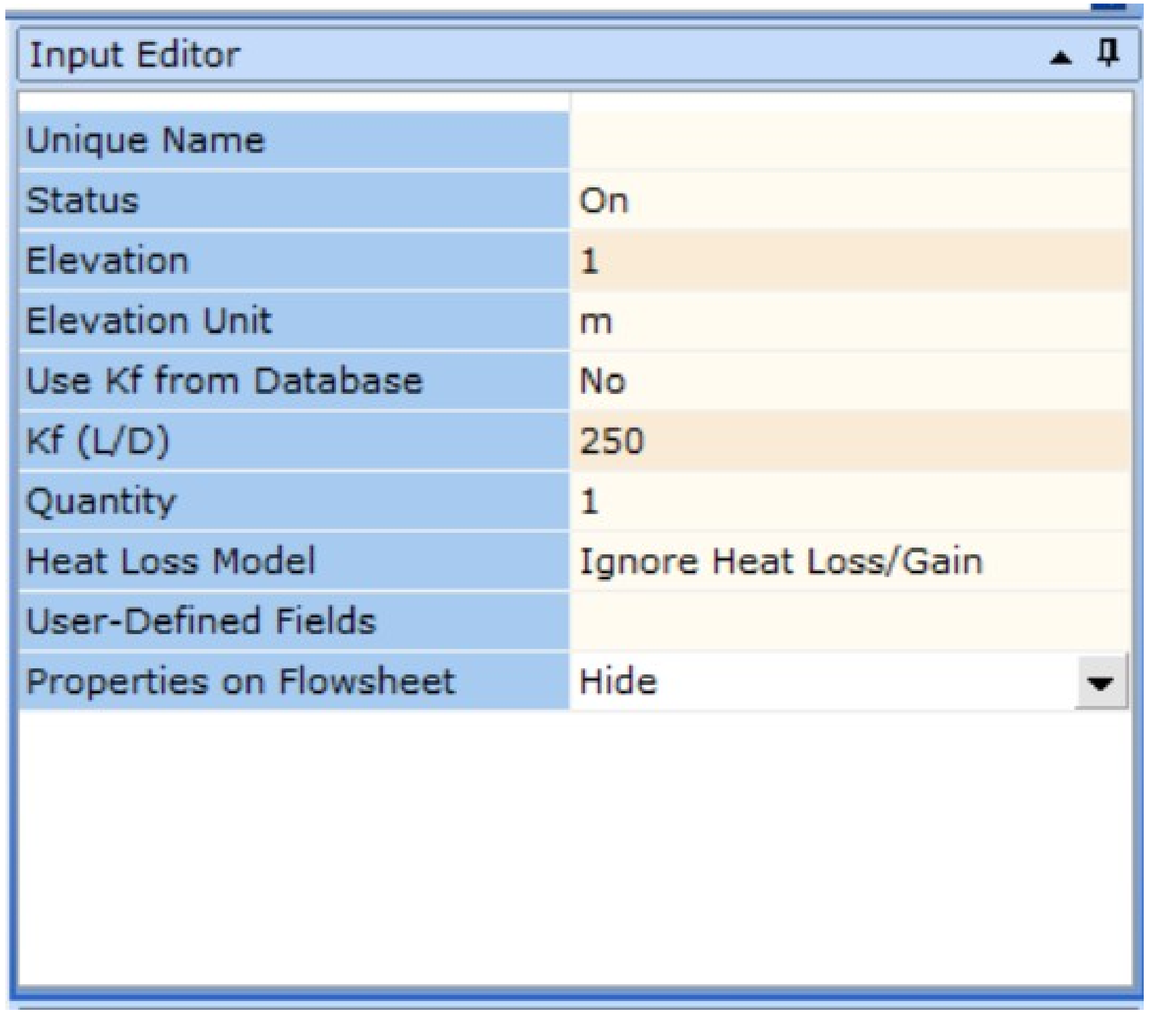


Kf [Equivalent Length (L/D)]

In terms of Pressure Drop

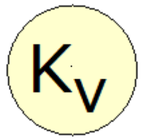
$$\Delta P = (\rho)\left(\frac{L}{D} \cdot f_{Turbulent}\right)\left(\frac{\bar{v}^2}{2g_c}\right)$$

$$\Delta P = (\rho)(K_f \cdot f_{Turbulent})\left(\frac{\bar{v}^2}{2g_c}\right)$$



FluidFlow User Interface

GENERAL RESISTANCES



Kv / Cv [Flow Coefficient]

$$\Delta P = \left(\frac{\rho_{Ref}}{\rho}\right)^{n-1} \left(\frac{m}{m_{Ref}}\right)^{n} \Delta P_{Ref}$$

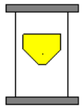
Data Palette

Messages | Input | Results | Chart | List | Watch

Unique Name	
Status	On
Elevation	0
Elevation Unit	ft
Use Kv from Database	No
Flow	1
Flow Unit	usgph
Pressure Loss	0.01
Pressure Loss Unit	psi
Reference Density	62.4
Density Unit	lb/ft3
Exponent	2
Quantity	1
Heat Loss Model	Ignore Heat Loss/Gain
Properties on Flowsheet	Hide

FluidFlow User Interface

GENERAL RESISTANCES



Constant Head Loss

Input Editor

Unique Name	
Status	On
Elevation	0
Elevation Unit	m
Pressure Loss (Constant)	0.136
Pressure Loss Unit	mbar
Quantity	1
Heat Loss Model	Ignore Heat Loss/Gain
User-Defined Fields	
Properties on Flowsheet	Hide

FluidFlow User Interface

GENERAL RESISTANCES

U User-Defined Generic

For a user-defined generic component, the pressure drop is calculated using this empirical formula:

$$\Delta P = K + ABQ^n + CDQ^m$$

Where:

ΔP is the pressure drop

Q is the flow rate

A, B, C, D, and K are the equation constants

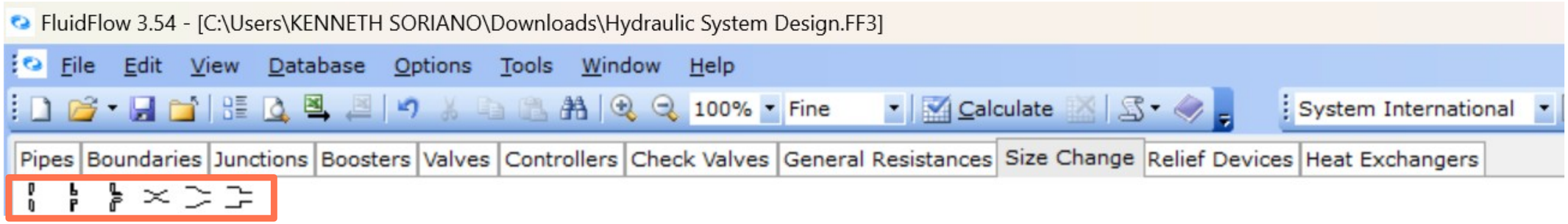
m, n are the exponents

Data Palette

Messages | Input | Results | Chart | List | Watch

Unique Name	Flame Arrester
Status	On
Elevation	0
Elevation Unit	m
Defining Equation	§P = K + ABQ^n + CDQ^m
Flow (Q) Unit	m3/h
Pressure Loss (§P) Unit	mbar
K Term Type	Fixed Value
K Value	0
A Term Type	Fixed Value
A Value	0.000243
B Term Type	Fixed Value
B Value	1
C Term Type	Fixed Value
C Value	0
D Term Type	Fixed Value
D Value	0
Exponent n	1.636134
Exponent m	0
Heat Loss Model	Ignore Heat Loss/Gain
Properties on Flowsheet	Hide

FluidFlow User Interface



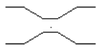
SIZE CHANGE

Thin Sharp-Edged Orifice

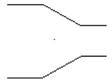
Thick Orifice



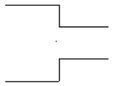
Inline Nozzle



Venturi Tube

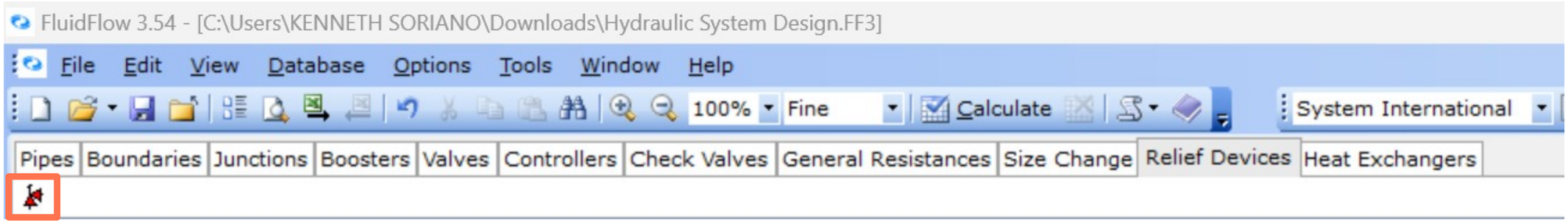


Reducer / Expander

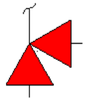


Abrupt Size Change

FluidFlow User Interface

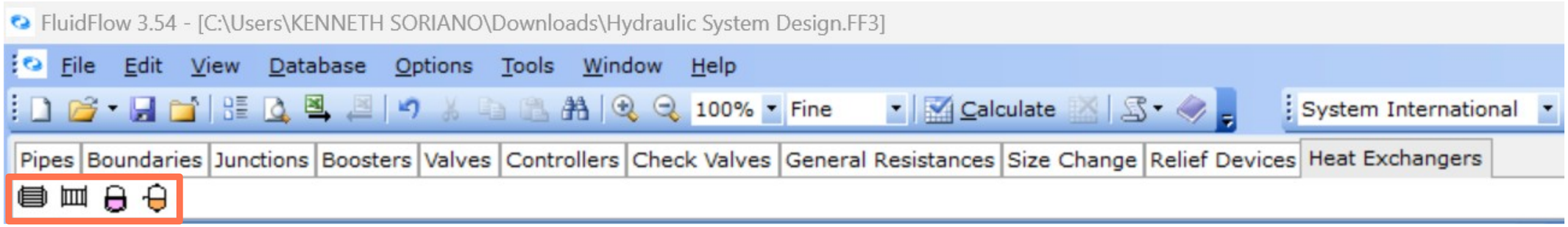


RELIEF DEVICE



Relief Valve Only / Bursting Disc Only / Relief Valve and Bursting Disc

FluidFlow User Interface



HEAT EXCHANGERS



Shell and Tube Heat Exchanger

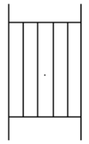
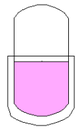


Plate Heat Exchanger



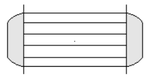
Jacketed Vessel (Process Side Only)



Knock Out Pot (Vapor/Liquid Separator)

FluidFlow User Interface

HEAT EXCHANGERS



Shell and Tube Heat Exchanger

Input Editor

Unique Name	
Status	On
Elevation	0
Elevation Unit	m
Pressure Loss Model	Standard Relationships
Fluid Side	Tubeside
Number of Tubes	20
Number of Tube Passes	1
Tube Diameter	20
Diameter Unit	mm
Tube Length	4
Length Unit	m
Heat Loss Model	Ignore Heat Loss/Gain
User-Defined Fields	
Properties on Flowsheet	Hide

Input Editor

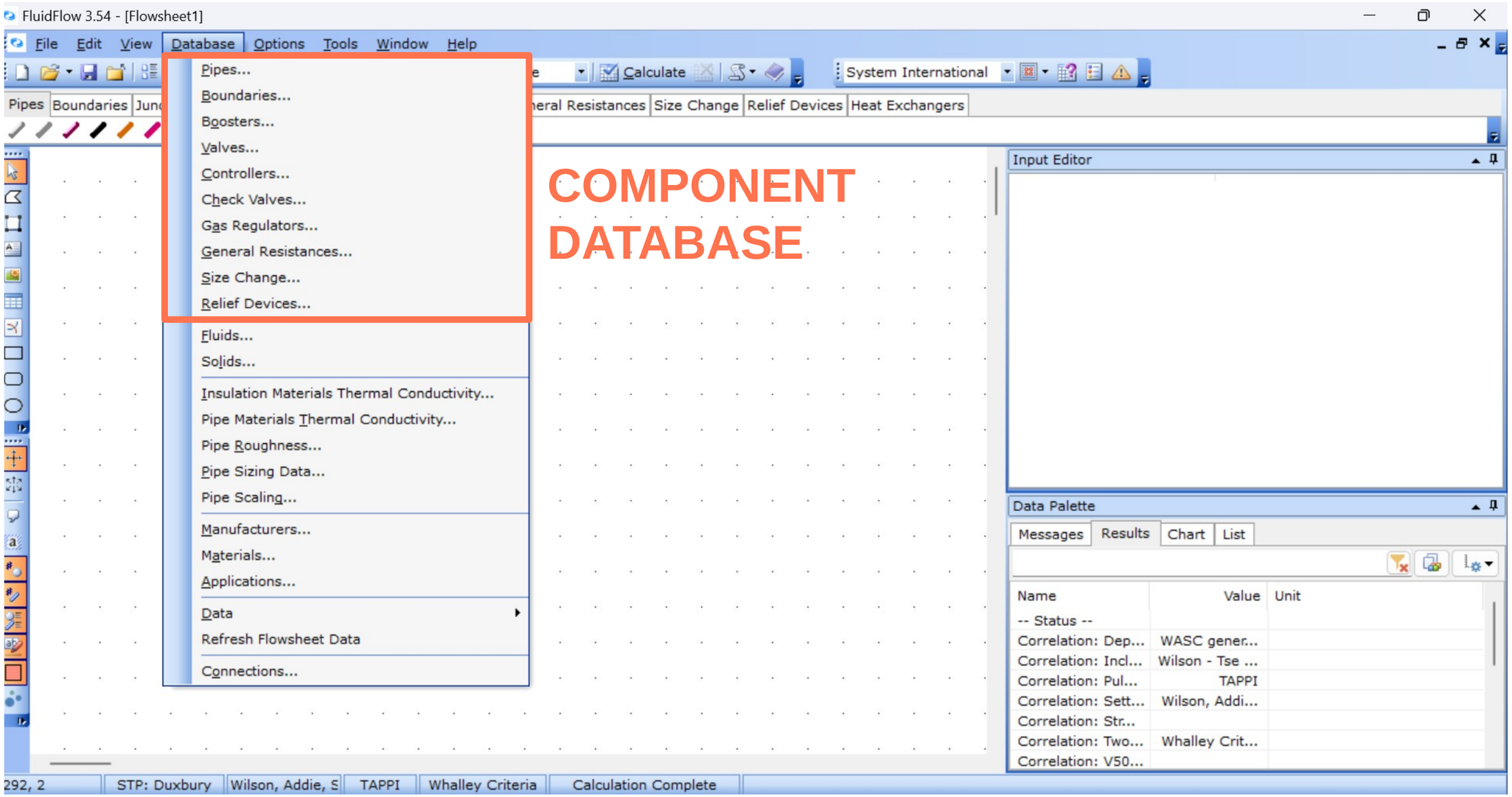
Unique Name	
Status	On
Elevation	0
Elevation Unit	m
Pressure Loss Model	Manufacturer Loss Data
Flow	1
Flow Unit	m3/h
Pressure Loss	1
Pressure Loss Unit	Pa
Reference Density	1000
Density Unit	kg/m3
Exponent	2
Heat Loss Model	Ignore Heat Loss/Gain
User-Defined Fields	
Properties on Flowsheet	Hide

Input Editor

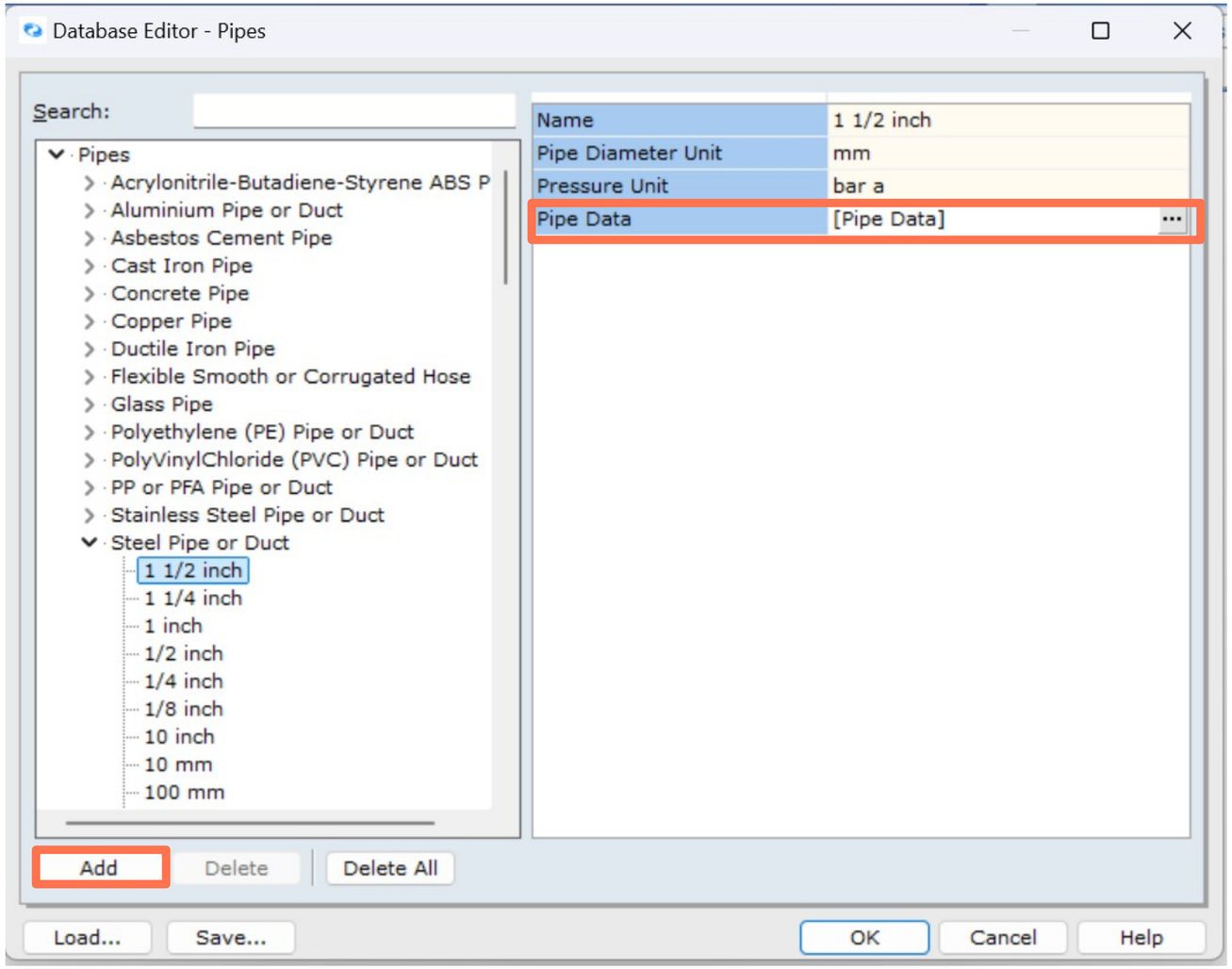
Unique Name	
Status	On
Elevation	0
Elevation Unit	m
Pressure Loss Model	Fixed Value
Pressure Loss (Constant)	1
Heat Loss Model	Ignore Heat Loss/Gain
Pressure Loss Unit	Pa
User-Defined Fields	
Properties on Flowsheet	Hide

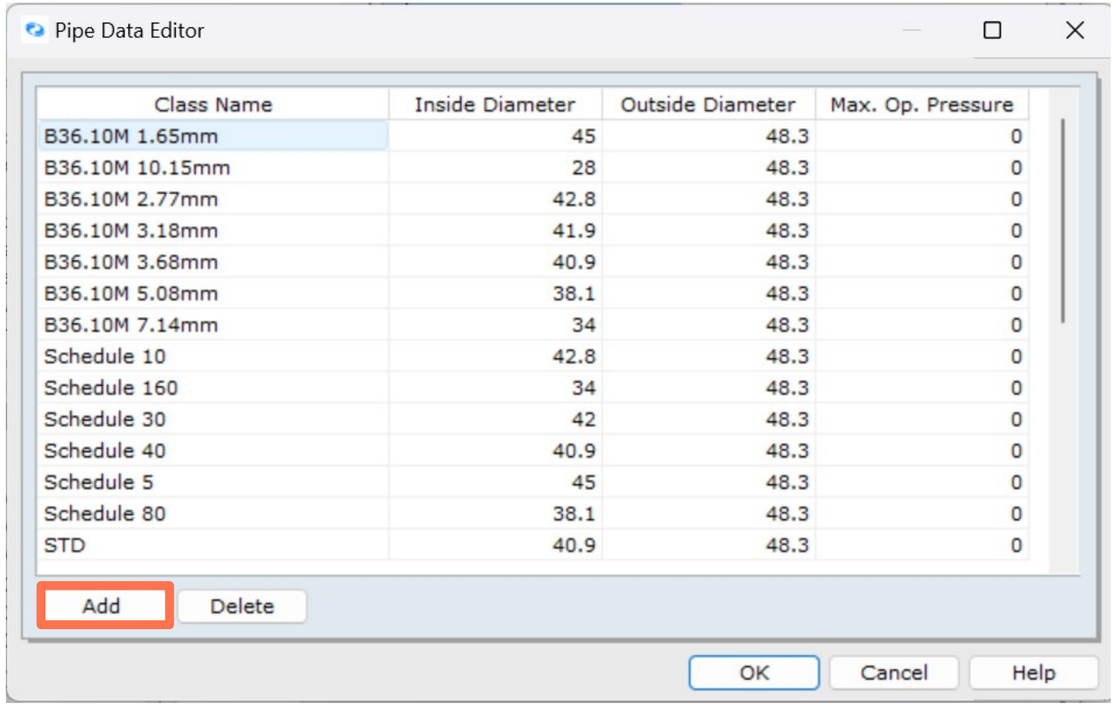
FLUIDFLOW DATABASE

FluidFlow Database (Component)

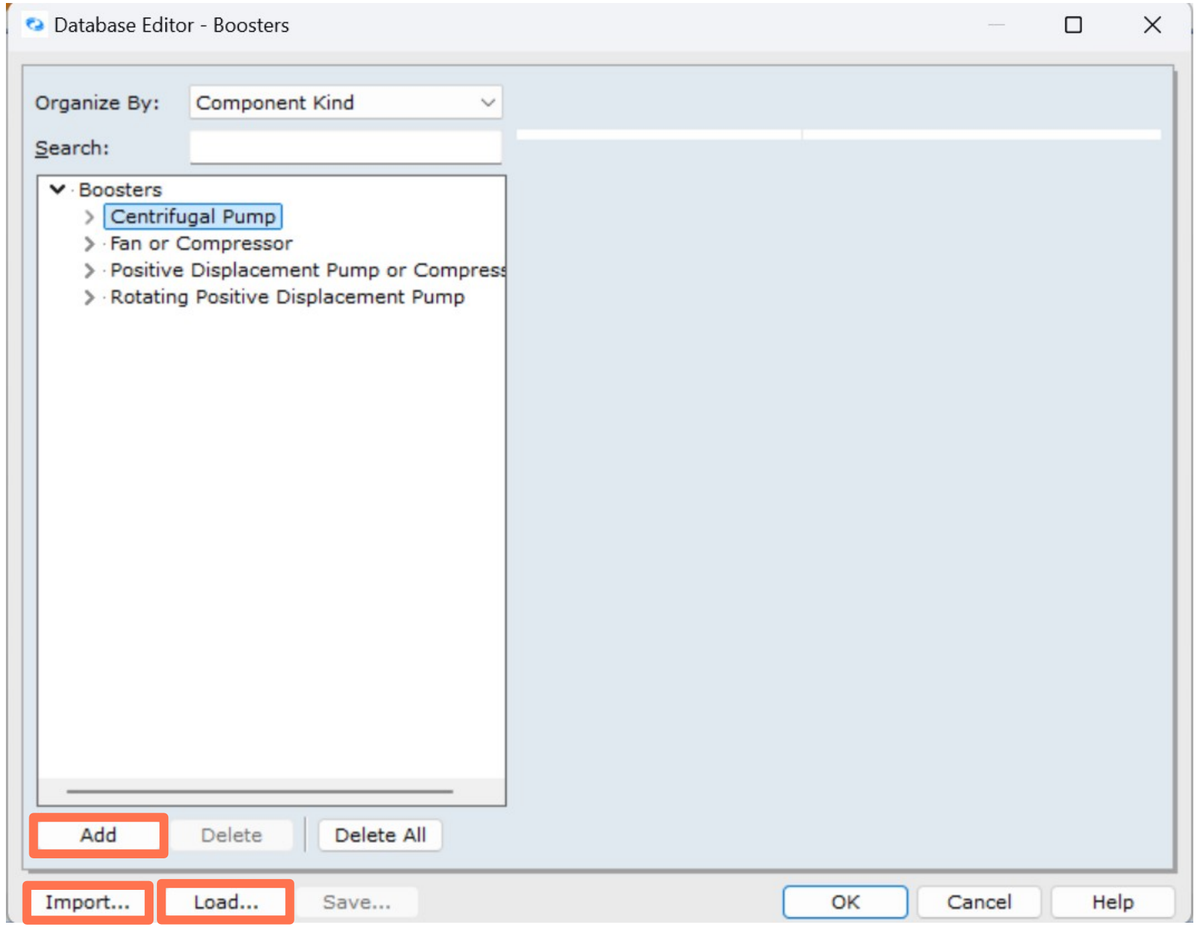


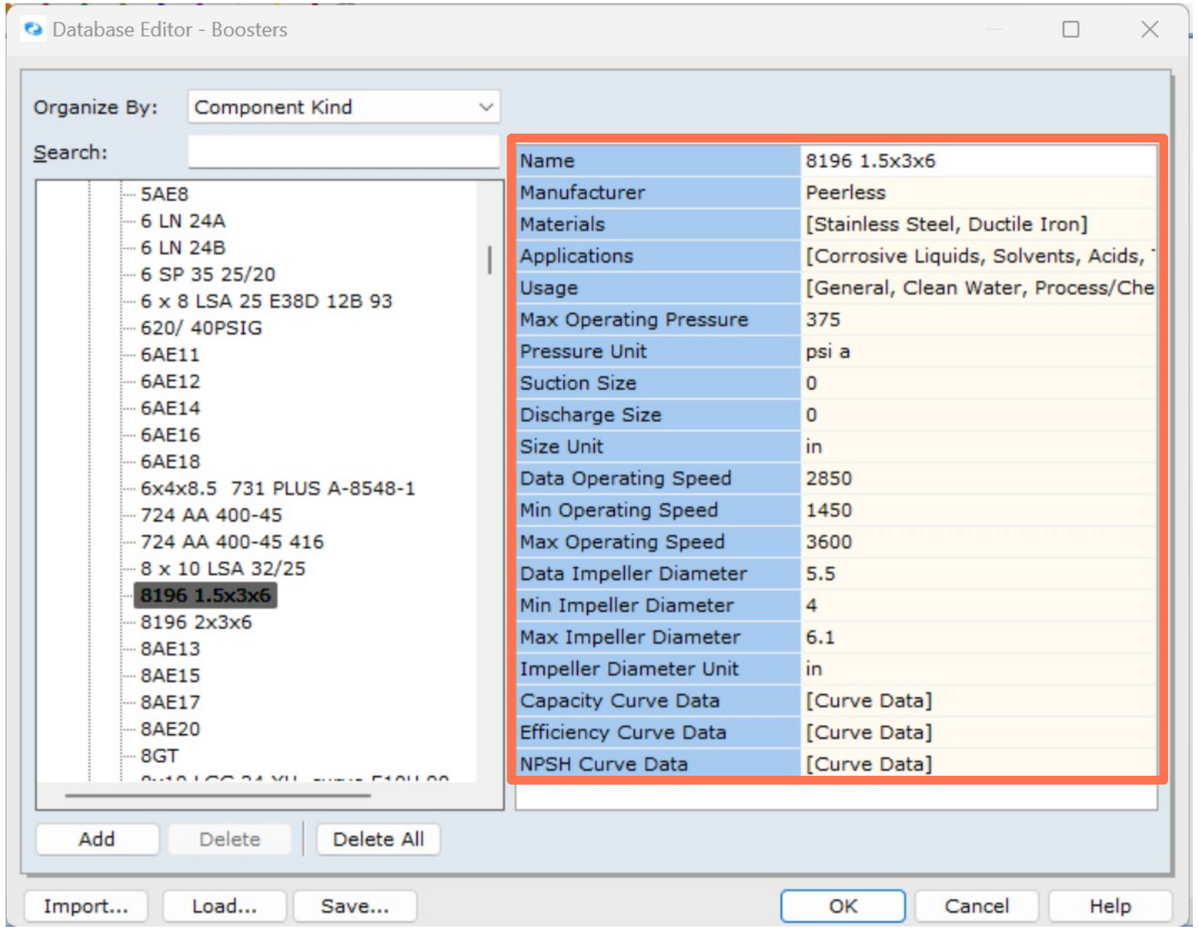
FluidFlow Database (Pipes)





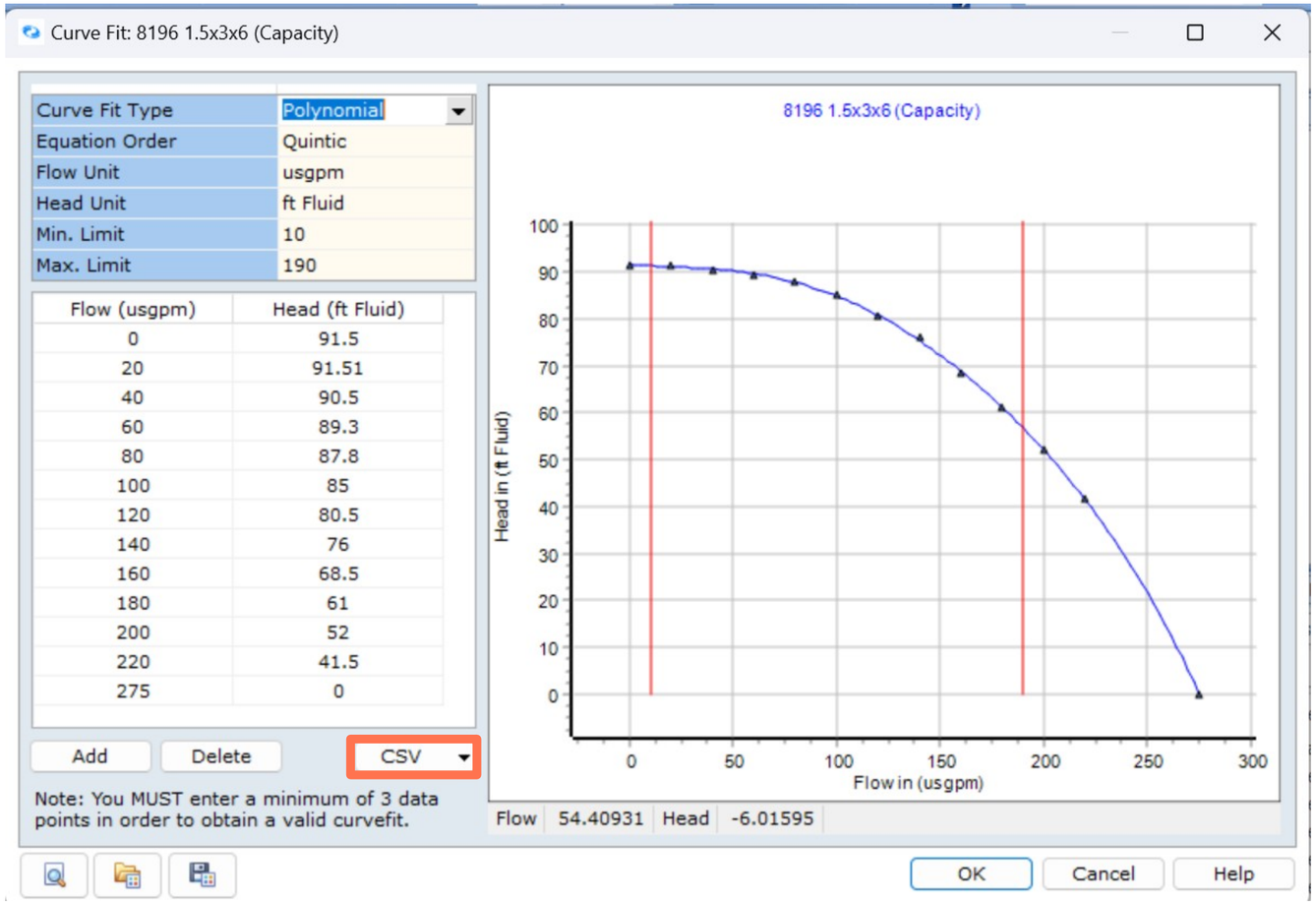
FluidFlow Database (Boosters)

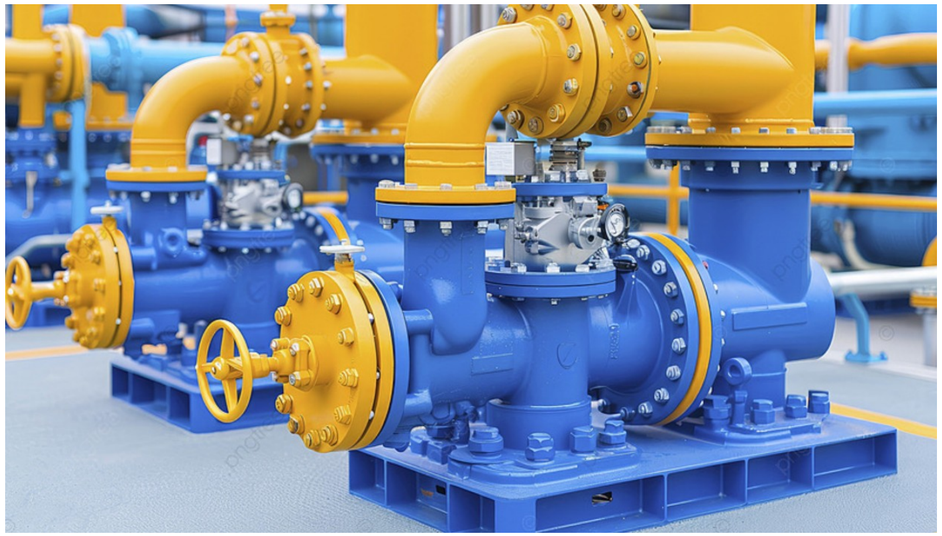




FluidFlow Database (Boosters)

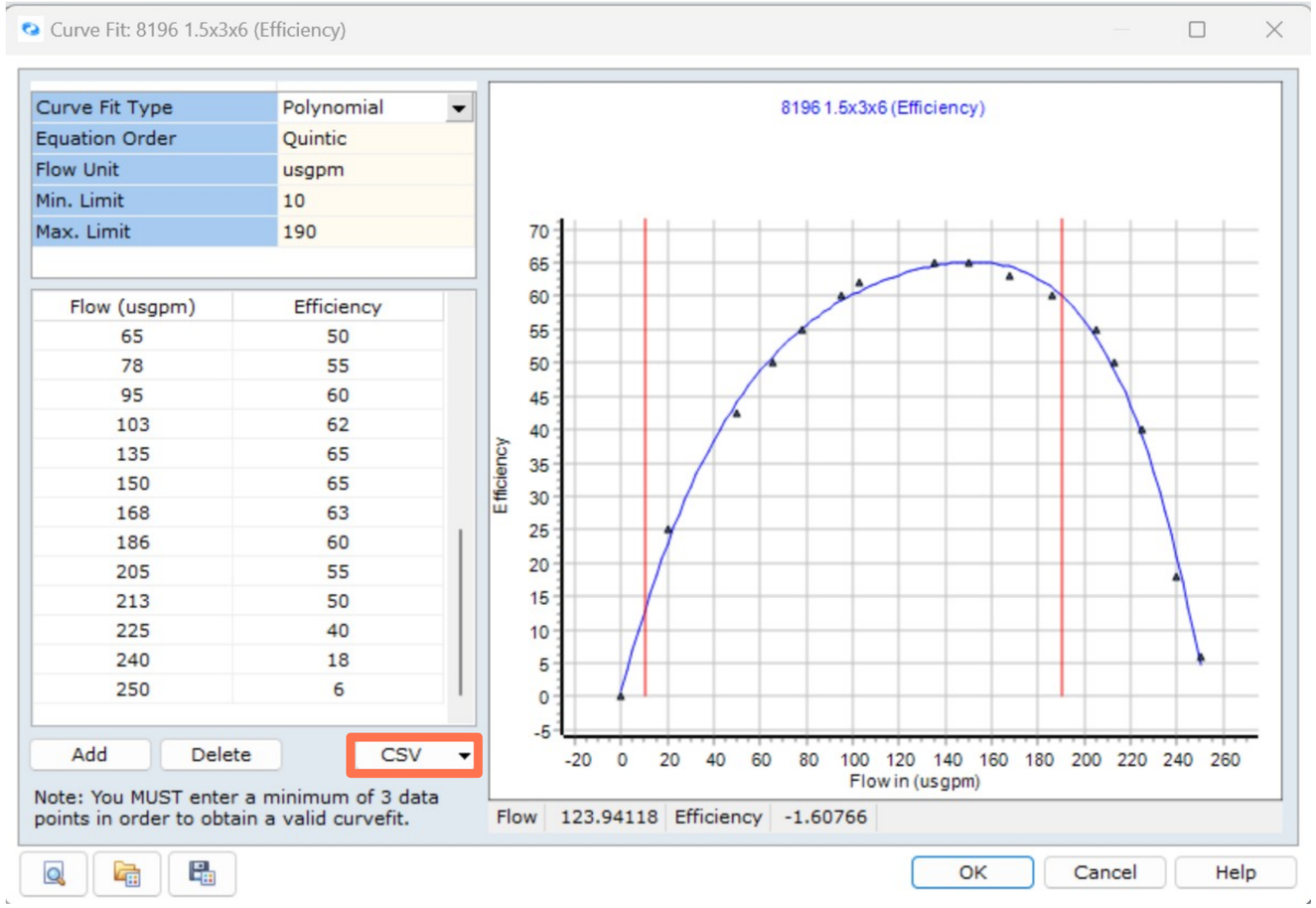
Pump Head vs. Flow Curve

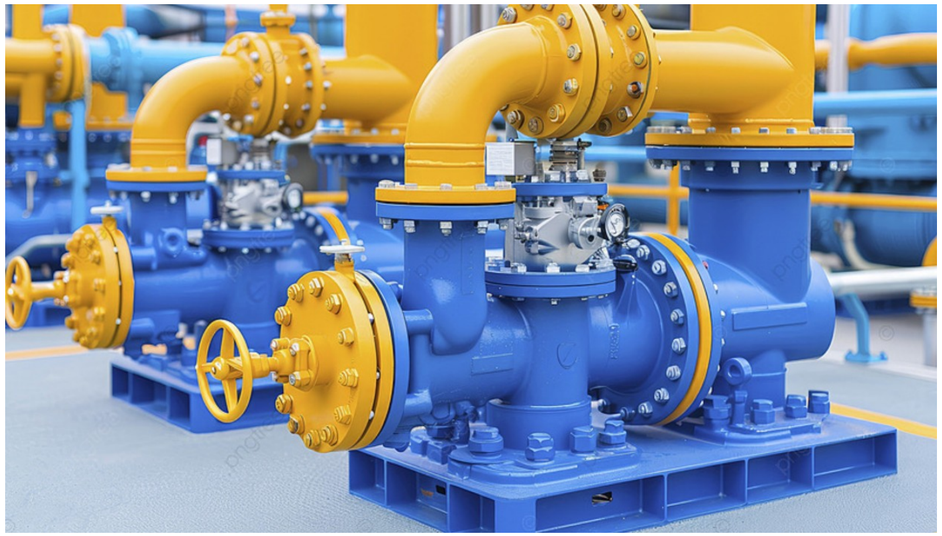




FluidFlow Database (Boosters)

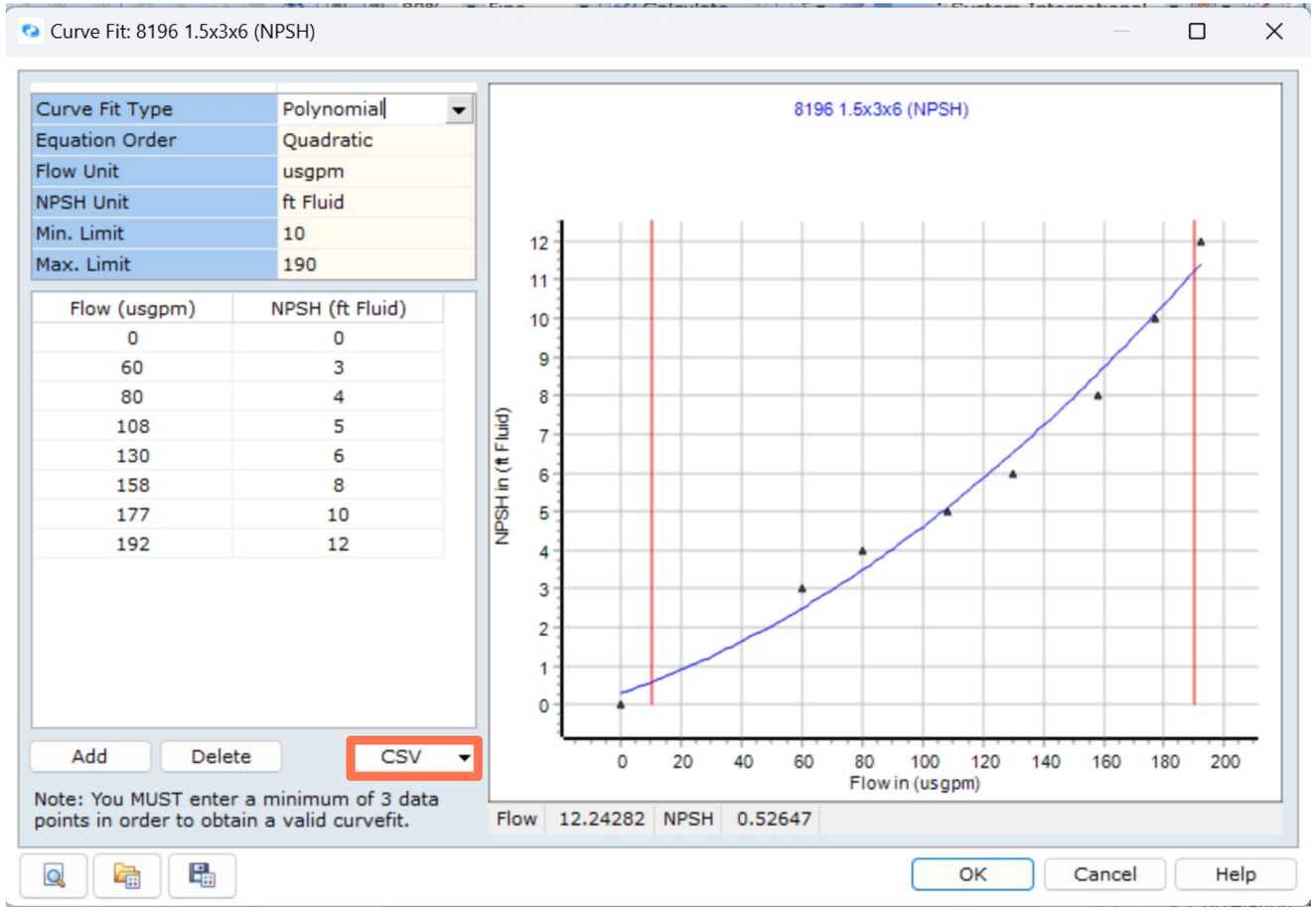
Pump Efficiency vs. Flow Curve

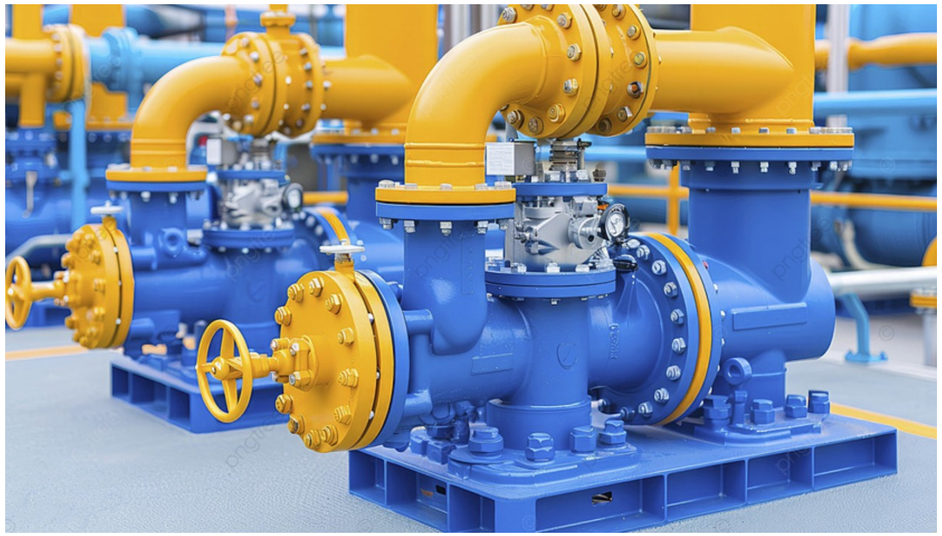




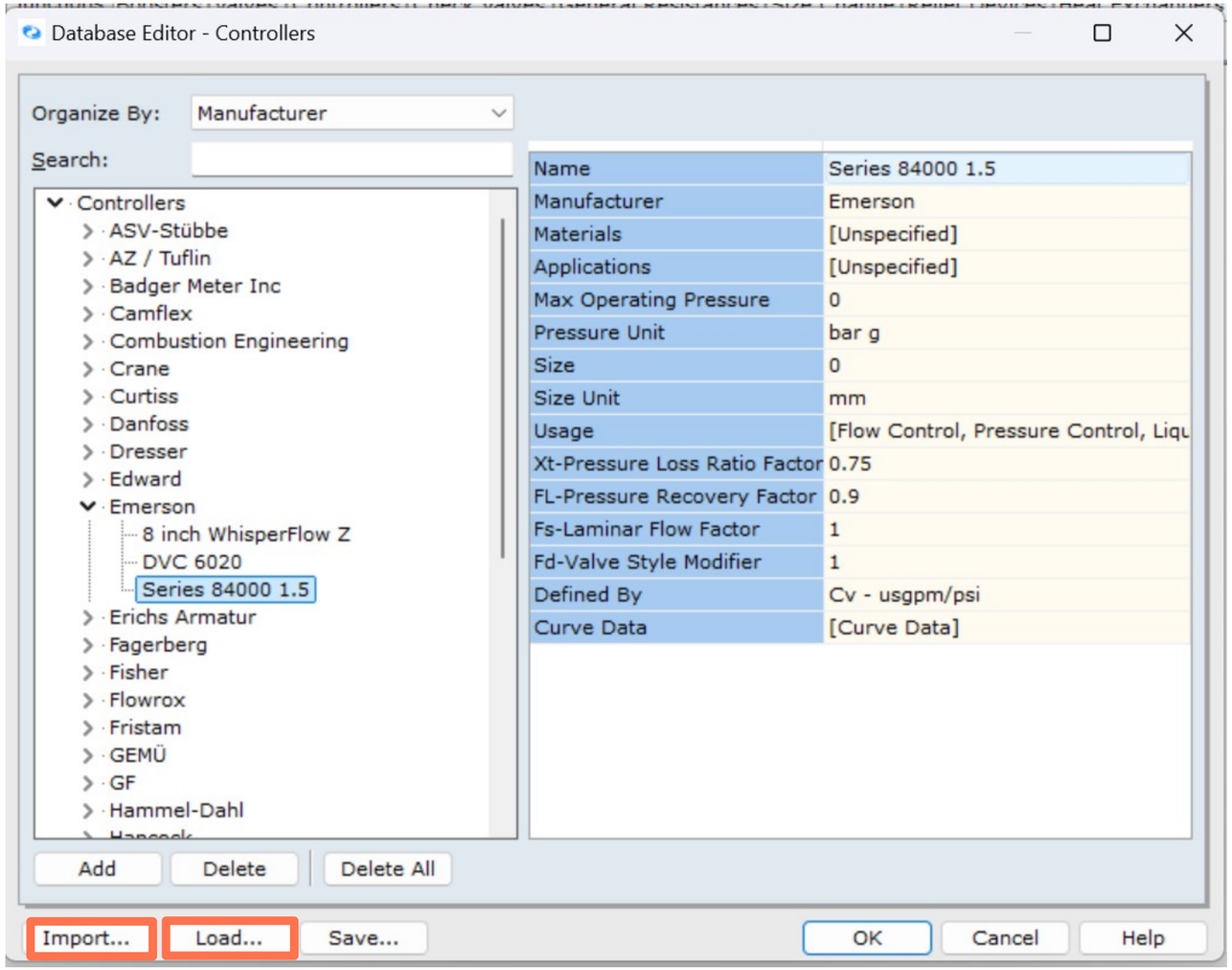
FluidFlow Database (Boosters)

Pump NPSHR vs. Flow Curve





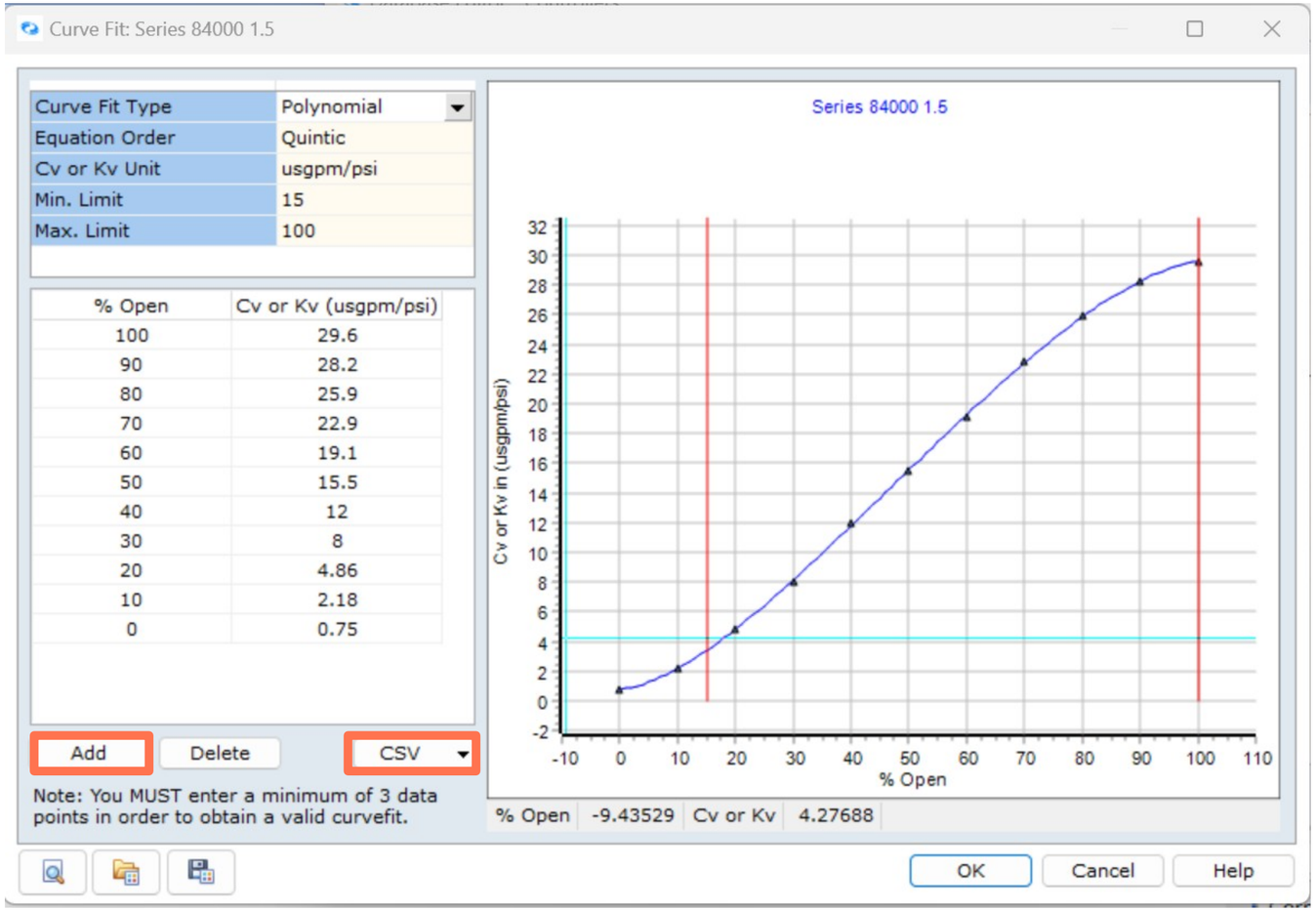
FluidFlow Database (Control Valves)





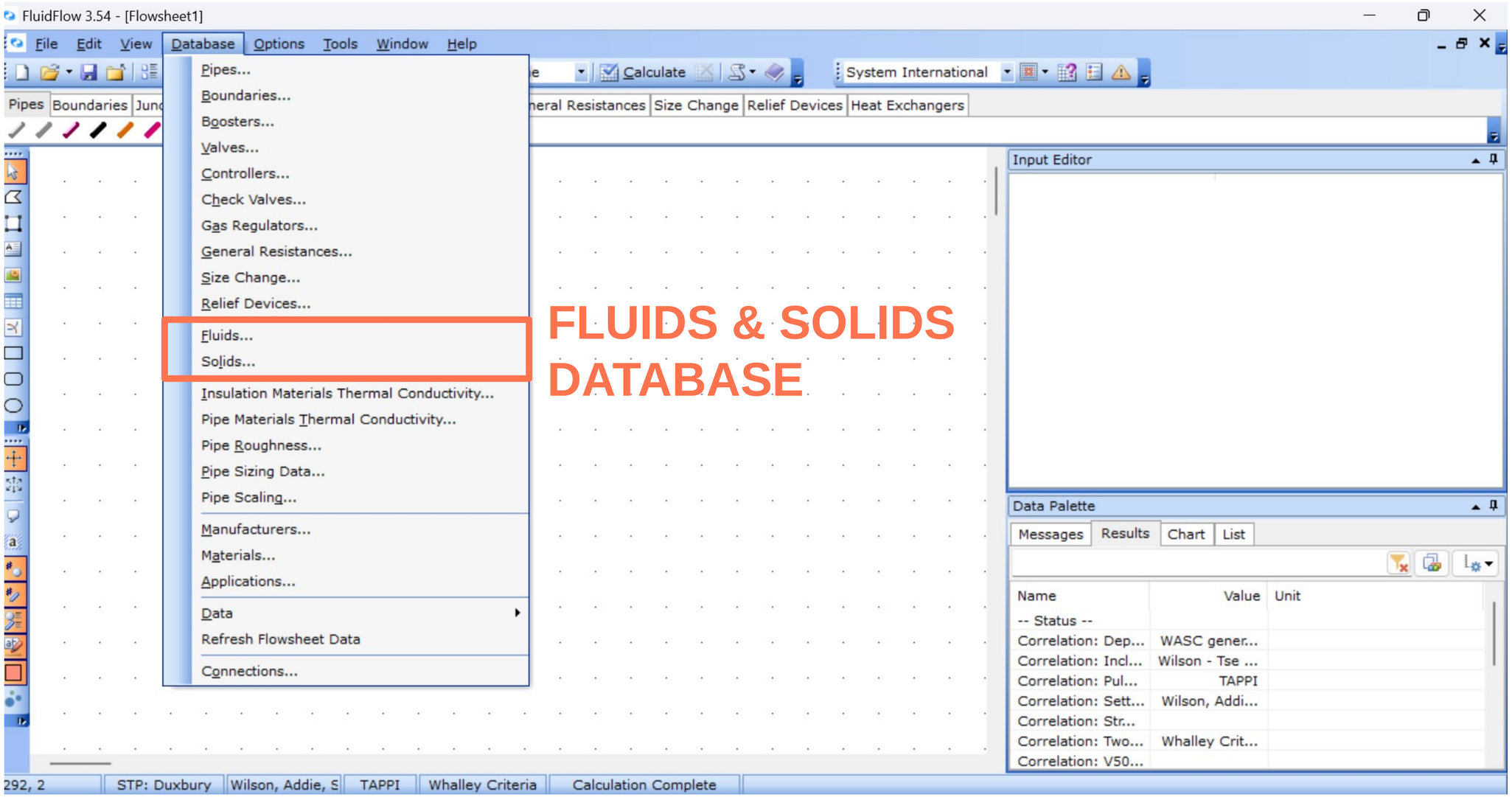
FluidFlow Database (Control Valves)

Cv Value vs. % Opening Curve

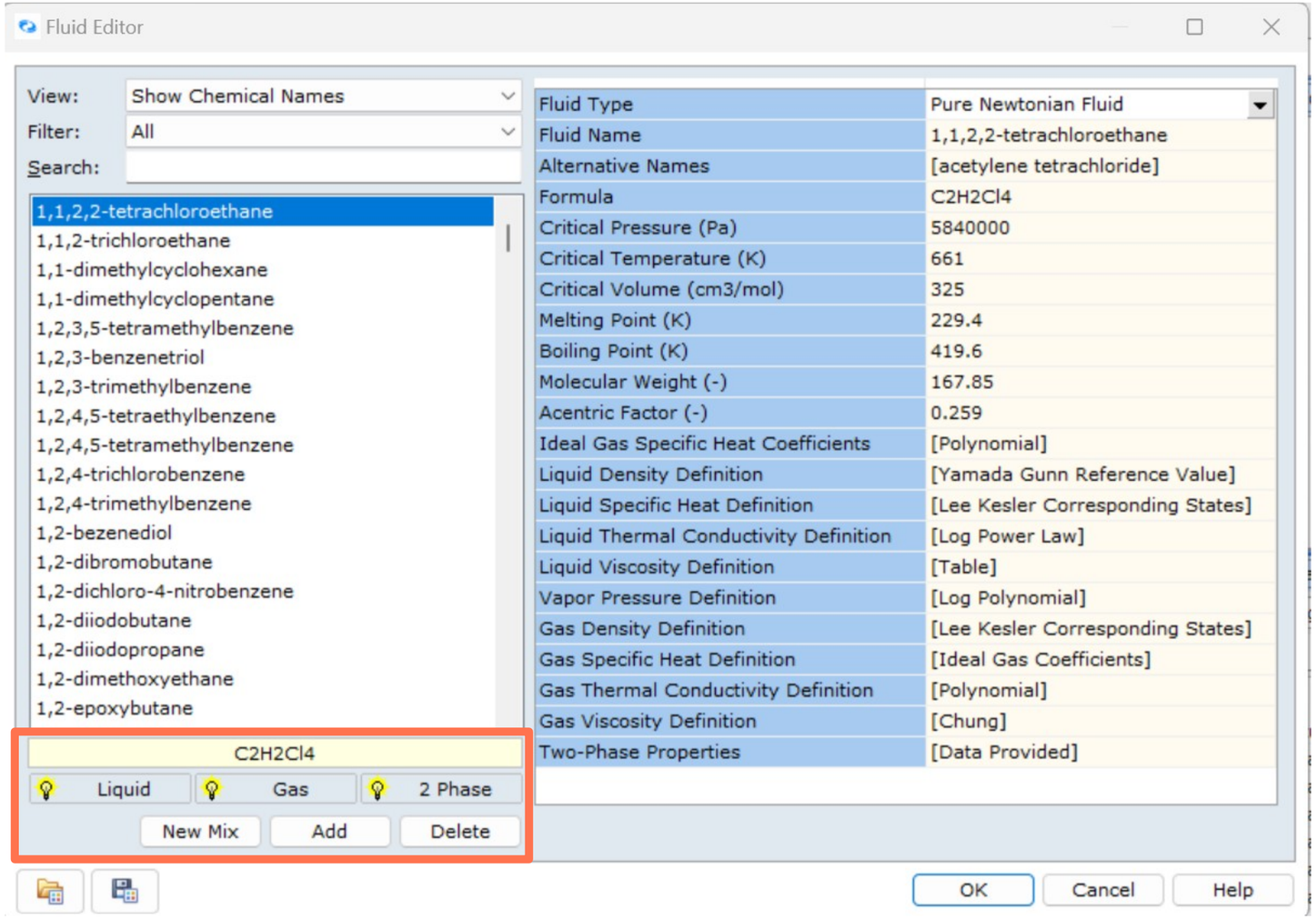




FluidFlow Database



FluidFlow Database (Fluids)



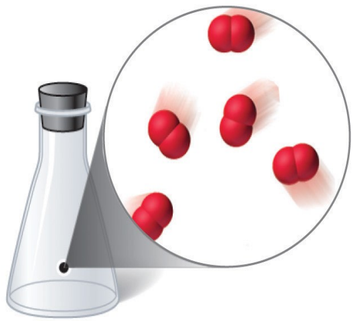
FluidFlow Database (Fluids)

Pure Newtonian Fluid (w/ Phase Change)

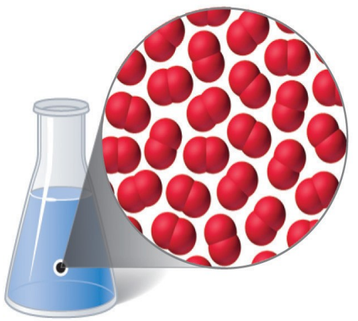
Fluid Type	Pure Newtonian Fluid
Fluid Name	1,1,2,2-tetrachloroethane
Alternative Names	[acetylene tetrachloride]
Formula	C2H2Cl4
Critical Pressure (Pa)	5840000
Critical Temperature (K)	661
Critical Volume (cm3/mol)	325
Melting Point (K)	229.4
Boiling Point (K)	419.6
Molecular Weight (-)	167.85
Acentric Factor (-)	0.259
Ideal Gas Specific Heat Coefficients	[Polynomial]
Liquid Density Definition	[Yamada Gunn Reference Value]
Liquid Specific Heat Definition	[Lee Kesler Corresponding States]
Liquid Thermal Conductivity Definition	[Log Power Law]
Liquid Viscosity Definition	[Table]
Vapor Pressure Definition	[Log Polynomial]
Gas Density Definition	[Lee Kesler Corresponding States]
Gas Specific Heat Definition	[Ideal Gas Coefficients]
Gas Thermal Conductivity Definition	[Polynomial]
Gas Viscosity Definition	[Chung]
Two-Phase Properties	[Data Provided]

Simple Newtonian Liquid

Fluid Type	Simple Newtonian Liquid
Fluid Name	Aviation Gasoline
Alternative Names	[]
Formula	N/A
Liquid Density Definition	[Table]
Liquid Specific Heat Definition	[Table]
Liquid Thermal Conductivity Definition	[Table]
Liquid Viscosity Definition	[Table]
Vapor Pressure Definition	[Table]



Gas

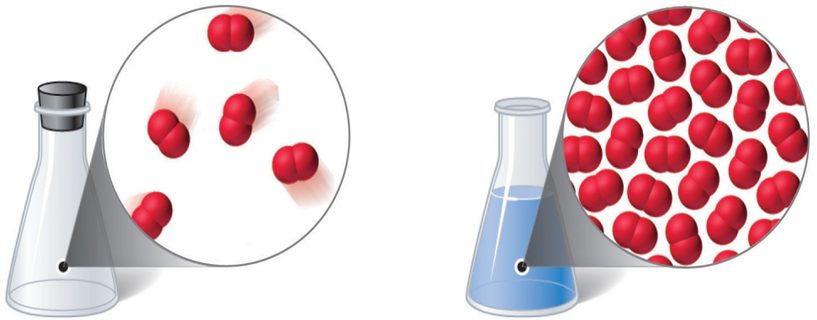


Liquid

FluidFlow Database (Fluids)

Non-Newtonian Liquid

Fluid Type	Non Newtonian Liquid
Fluid Name	Honey
Alternative Names	[]
Formula	N/A
Liquid Density Definition	[Fixed Value]
Liquid Specific Heat Definition	[Fixed Value]
Liquid Thermal Conductivity Definition	[Fixed Value]
Liquid Viscosity Definition	[Non Newtonian - Power Law]
Vapor Pressure Definition	[As Water]



Gas

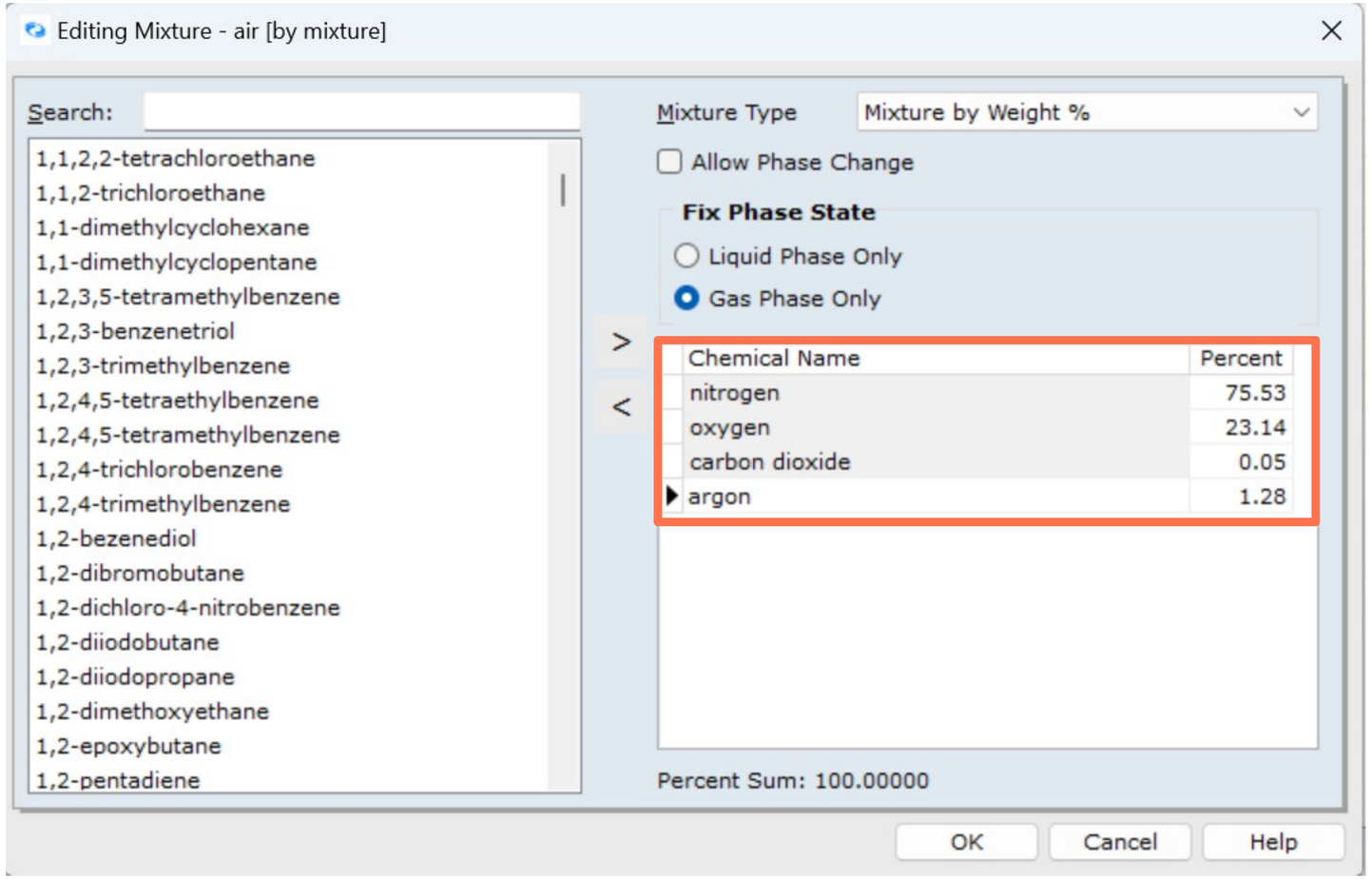
Liquid

Gas (No Phase Change)

Fluid Type	Gas (No Phase Change)
Fluid Name	silicon tetrafluoride
Alternative Names	[]
Formula	SiF4
Critical Pressure (Pa)	3719000
Critical Temperature (K)	259
Critical Volume (cm3/mol)	165
Molecular Weight (-)	104.079
Acentric Factor (-)	0.385
Ideal Gas Specific Heat Coefficients	[Polynomial]
Gas Density Definition	[BWR HS EOS]
Gas Specific Heat Definition	[Ideal Gas Coefficients]
Gas Thermal Conductivity Definition	[Polynomial]
Gas Viscosity Definition	[Polynomial]

FluidFlow Database (Fluids)

Mixture by Weight % / Mole %



FluidFlow Database (Fluids)

Petroleum Fraction or Crude

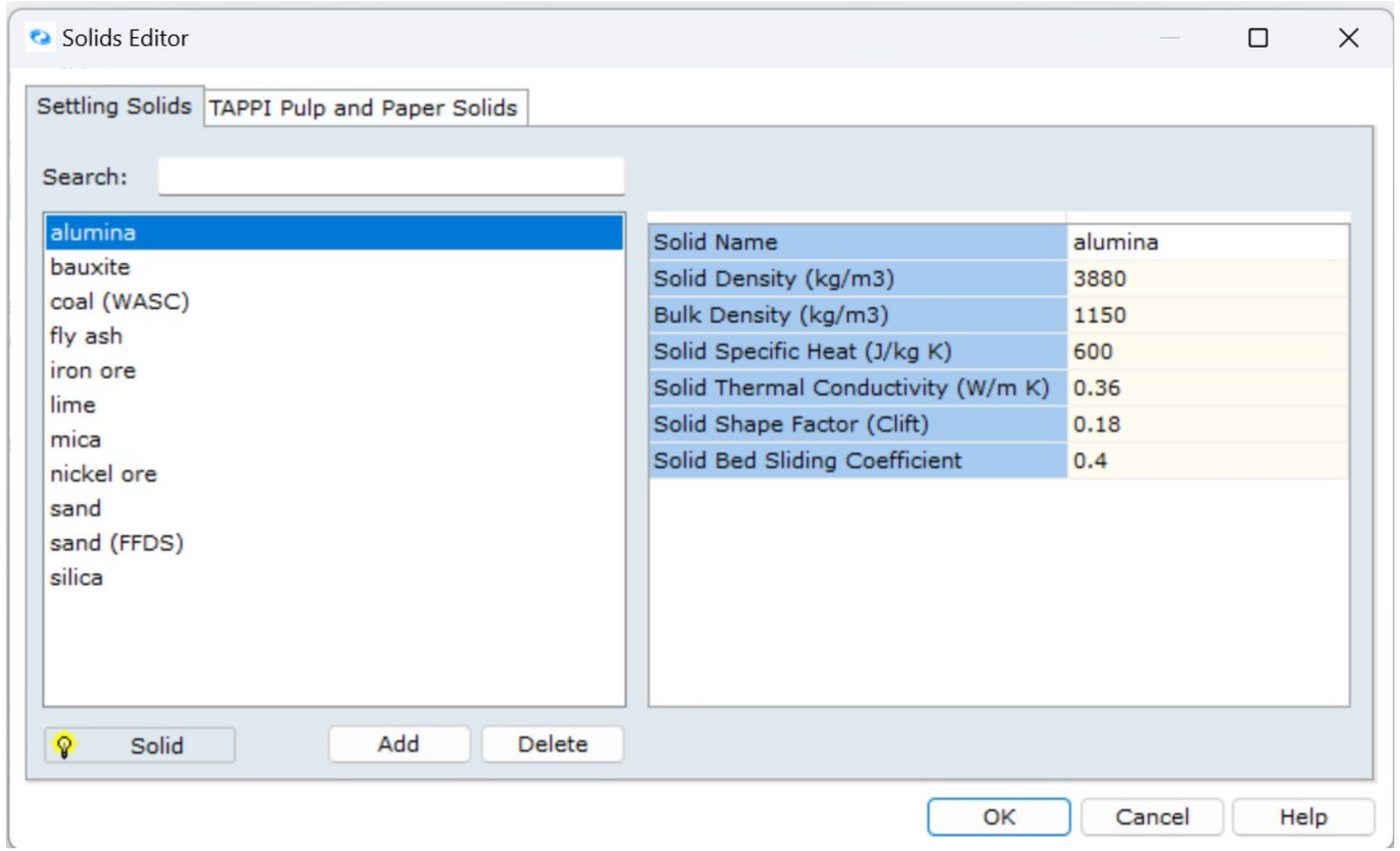
Fluid Type	Petroleum Fraction or Crude
Fluid Name	kerosene
Alternative Names	[]
Formula	N/A
Specific Gravity of Liquid at 288.65K	0.82
Boiling Point Curve Definition	[ASTM D86]
Critical Pressure (Pa)	[Estimated Value = 2147316]
Critical Temperature (K)	[Estimated Value = 679.6]
Critical Volume (cm3/mol)	[Estimated Value = 638.1]
Boiling Point (K)	[Estimated Value = 496.86]
Molecular Weight (-)	[Estimated Value = 174.608]
Acentric Factor (-)	[Estimated Value = 0.5580]
Watson K Factor (-)	[Estimated Value = 11.723]
Liquid Density Definition	[Spencer Danner]
Liquid Specific Heat Definition	[Lee Kesler Corresponding States]
Liquid Thermal Conductivity Definition	[Sato Riedel]
Liquid Viscosity Definition	[Moharam, Al-Mehaideb and Fahim]
Vapor Pressure Definition	[Lee Kesler]
Gas Density Definition	[Peng Robinson EOS]
Gas Specific Heat Definition	[Lee Kesler Corresponding States]
Gas Thermal Conductivity Definition	[Chung]
Gas Viscosity Definition	[Chung]





FluidFlow Database (Solids)

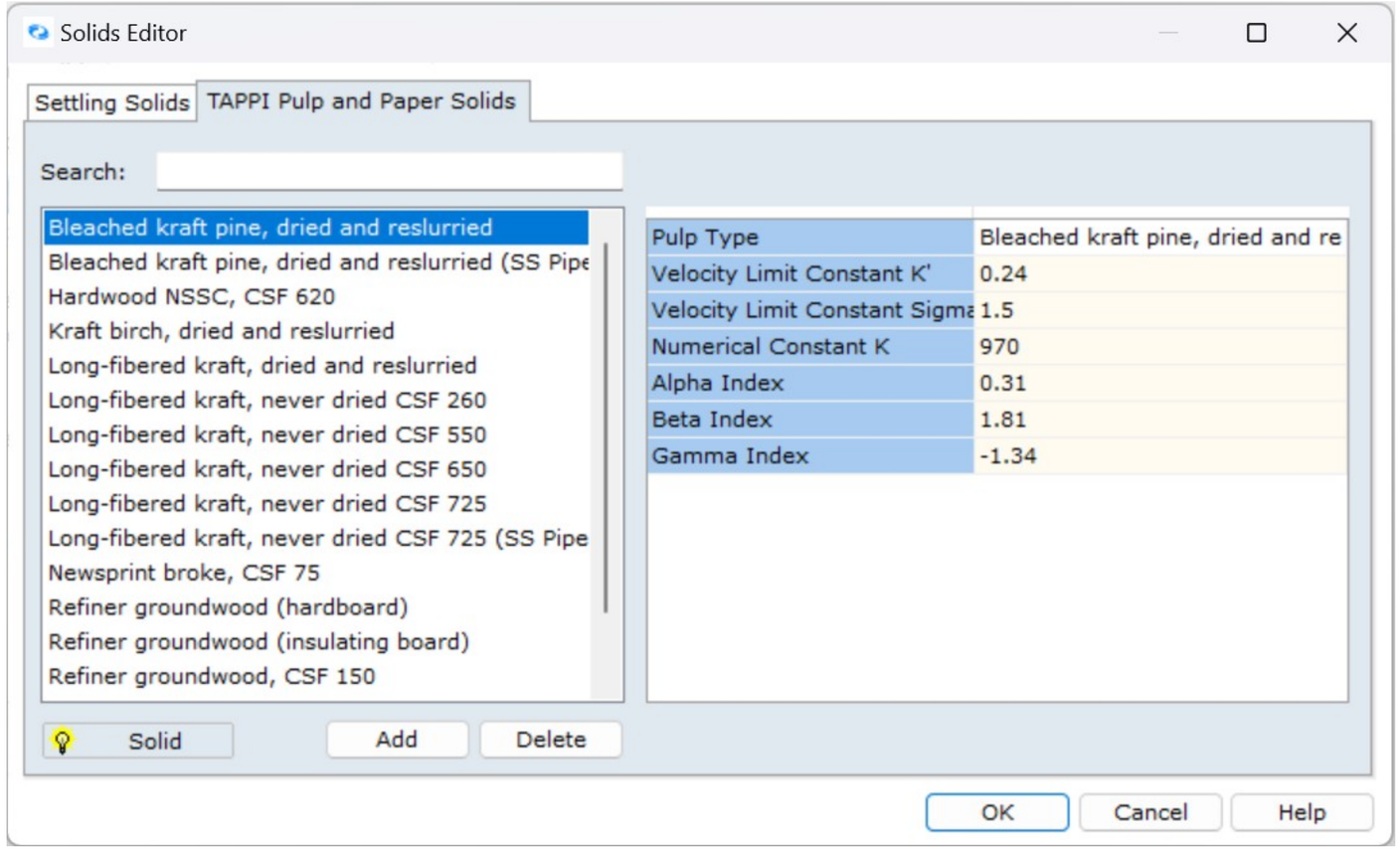
Settling Solids





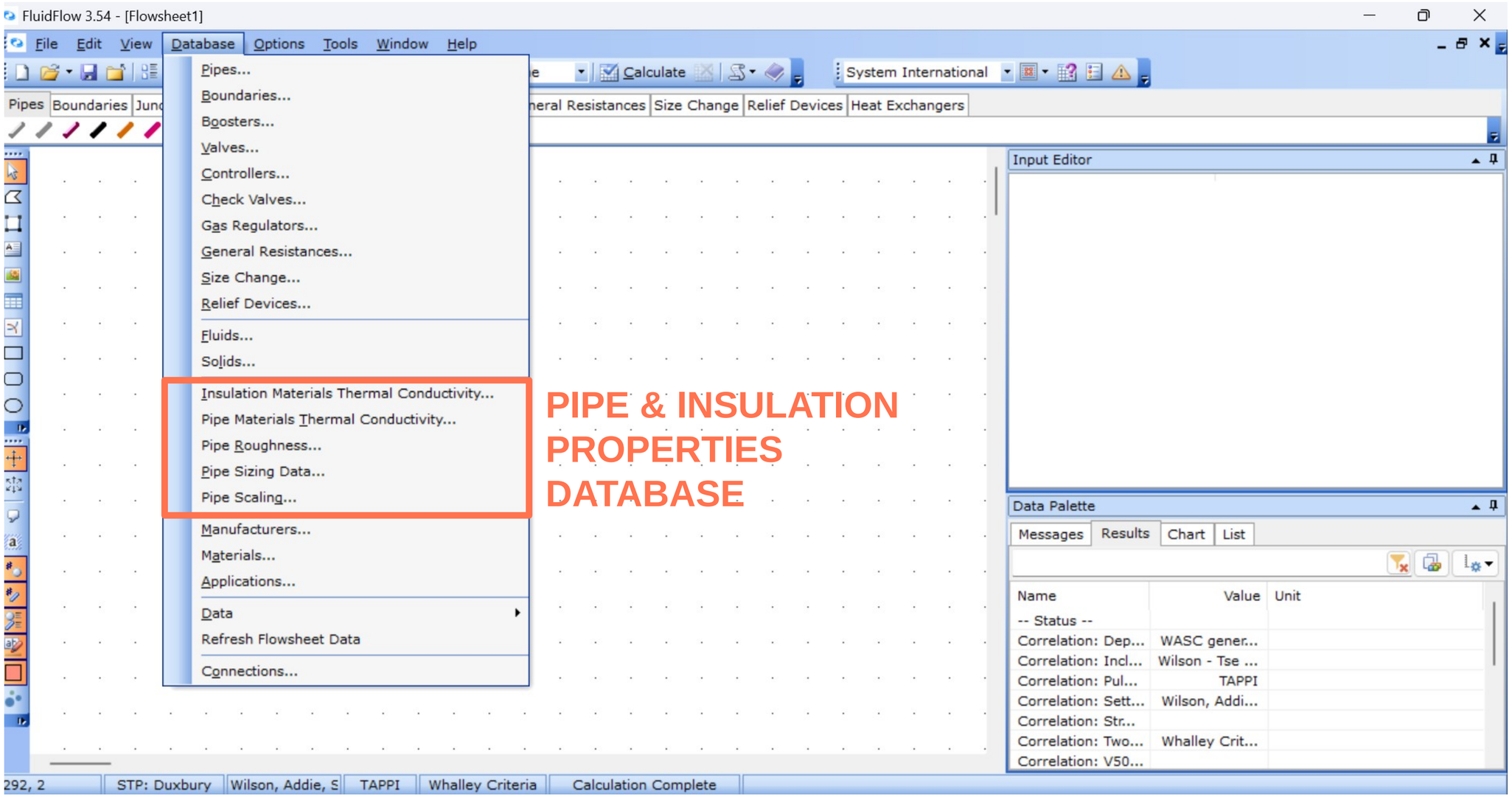
FluidFlow Database (Solids)

TAPPI Pulp and Paper Solids



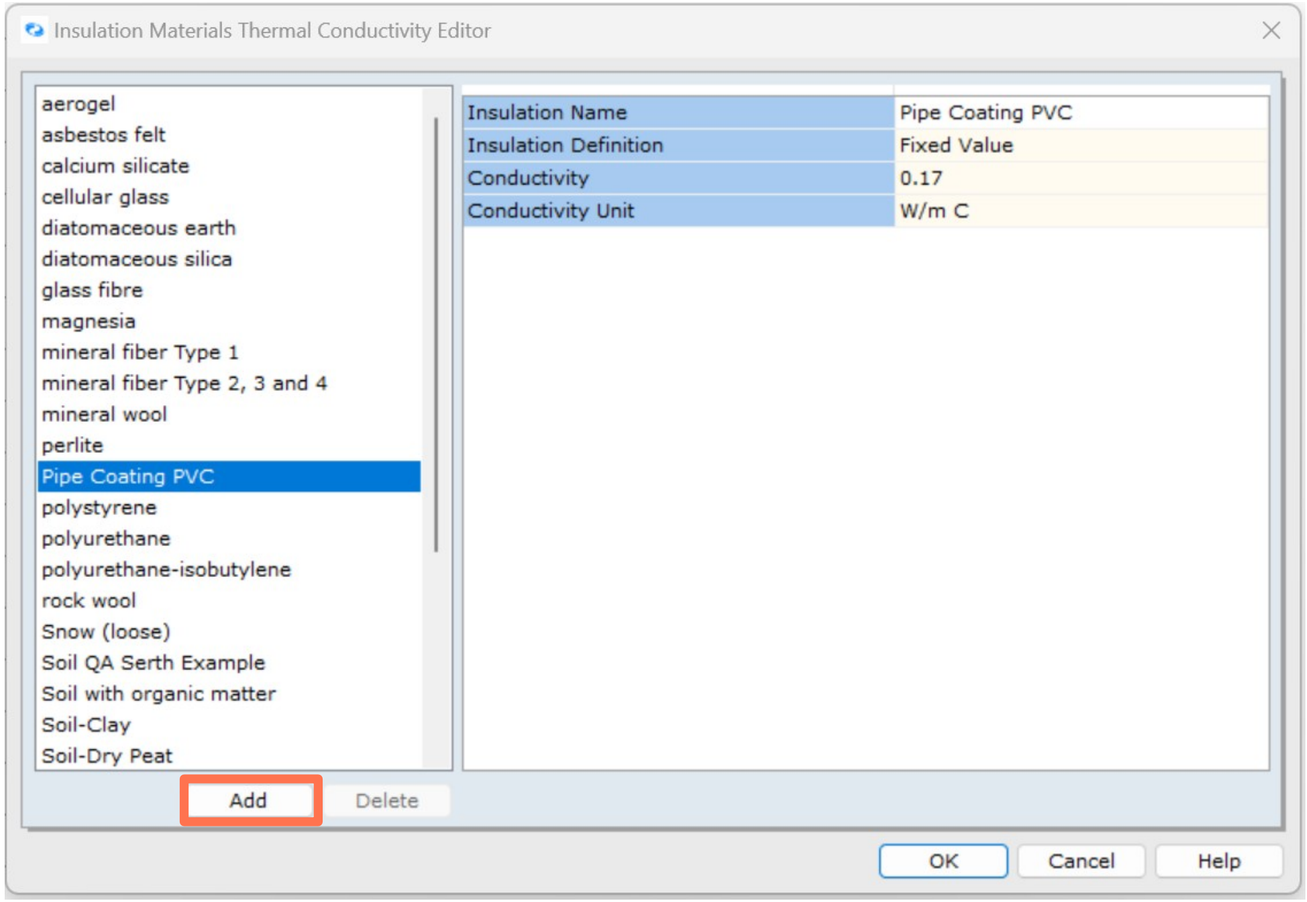


FluidFlow Database (Pipe & Insulation Properties)



FluidFlow Database (Pipe & Insulation Properties)

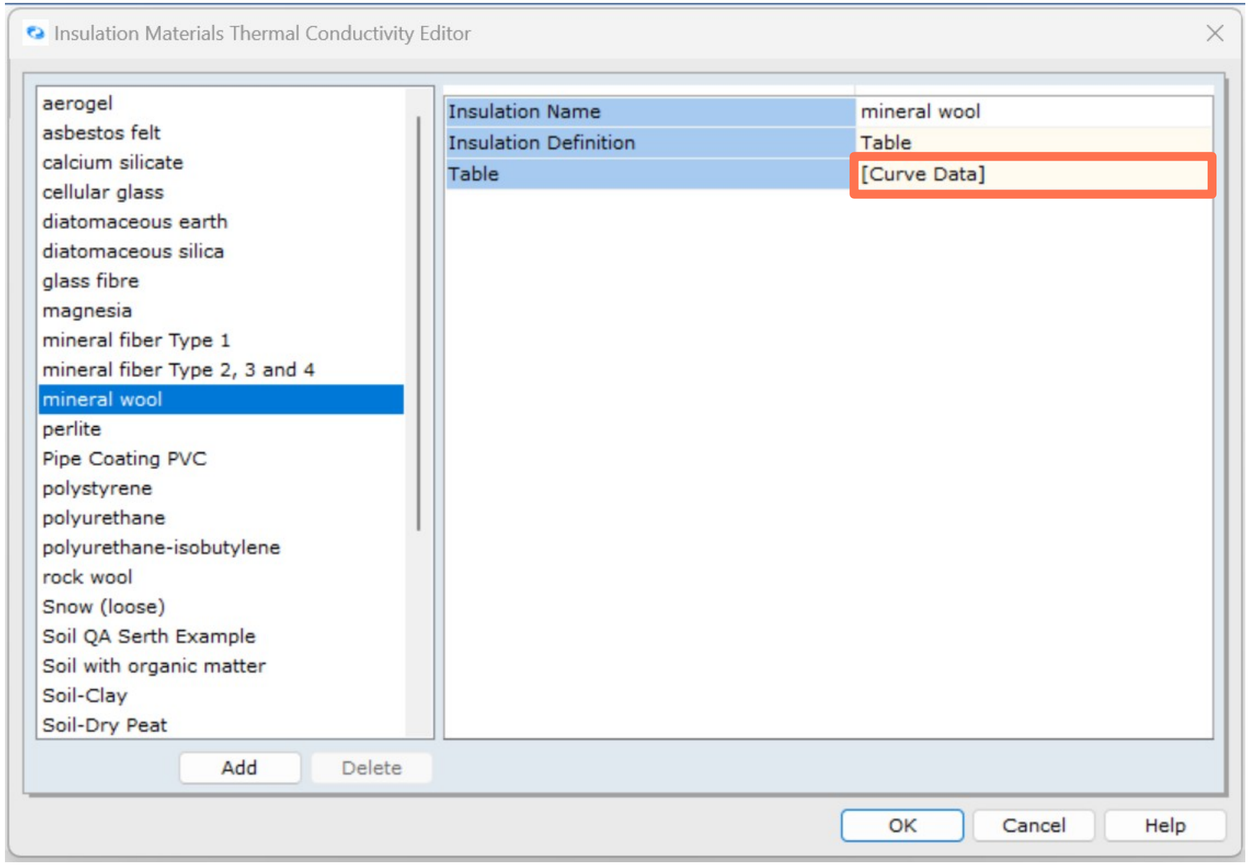
Insulation Materials Thermal Conductivity

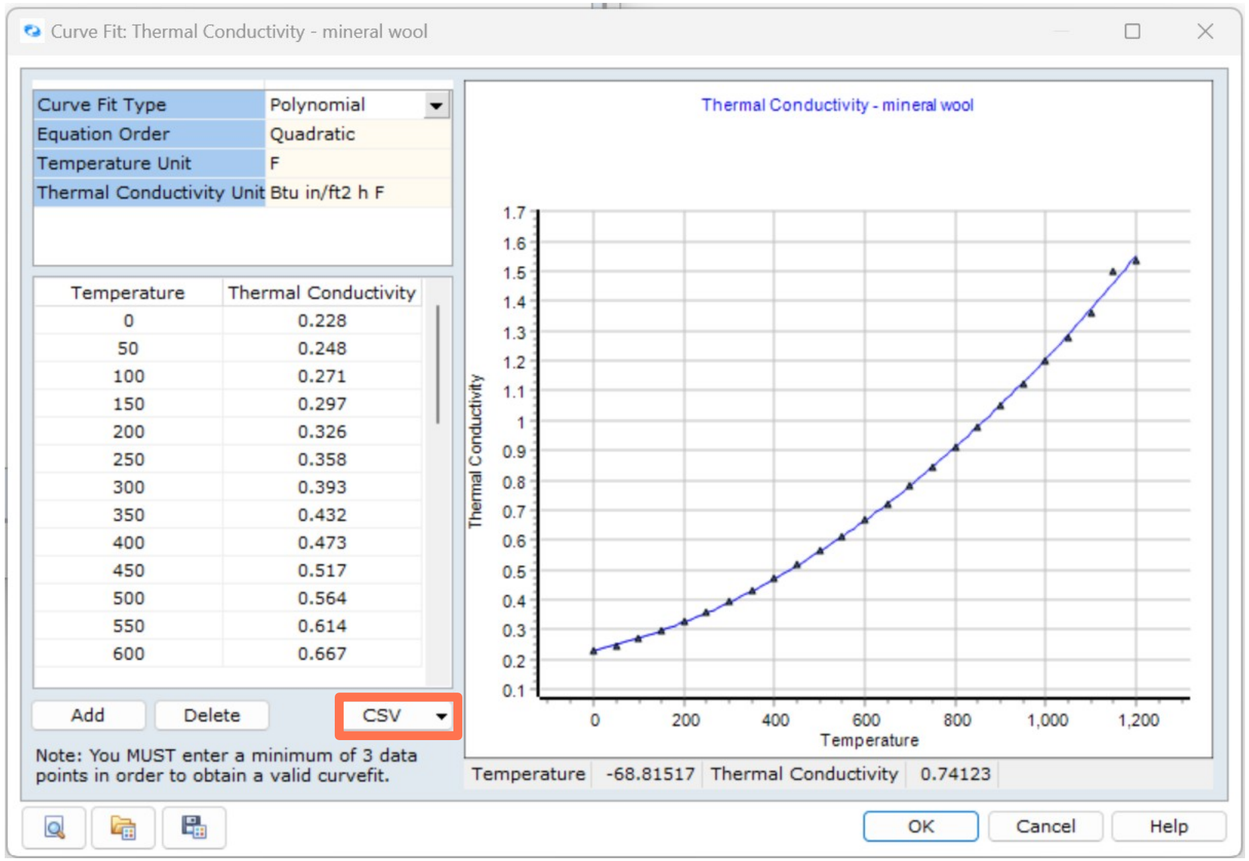




FluidFlow Database (Pipe & Insulation Properties)

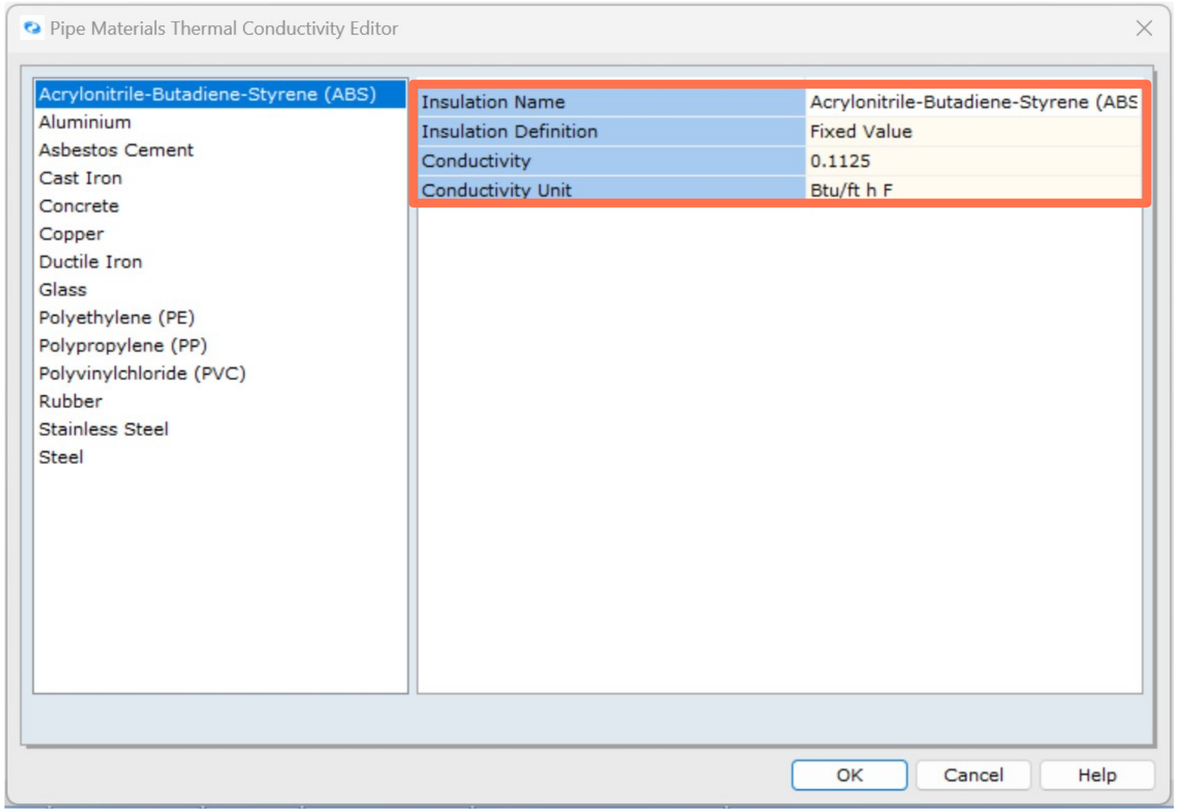
Insulation Materials Thermal Conductivity





FluidFlow Database (Pipe & Insulation Properties)

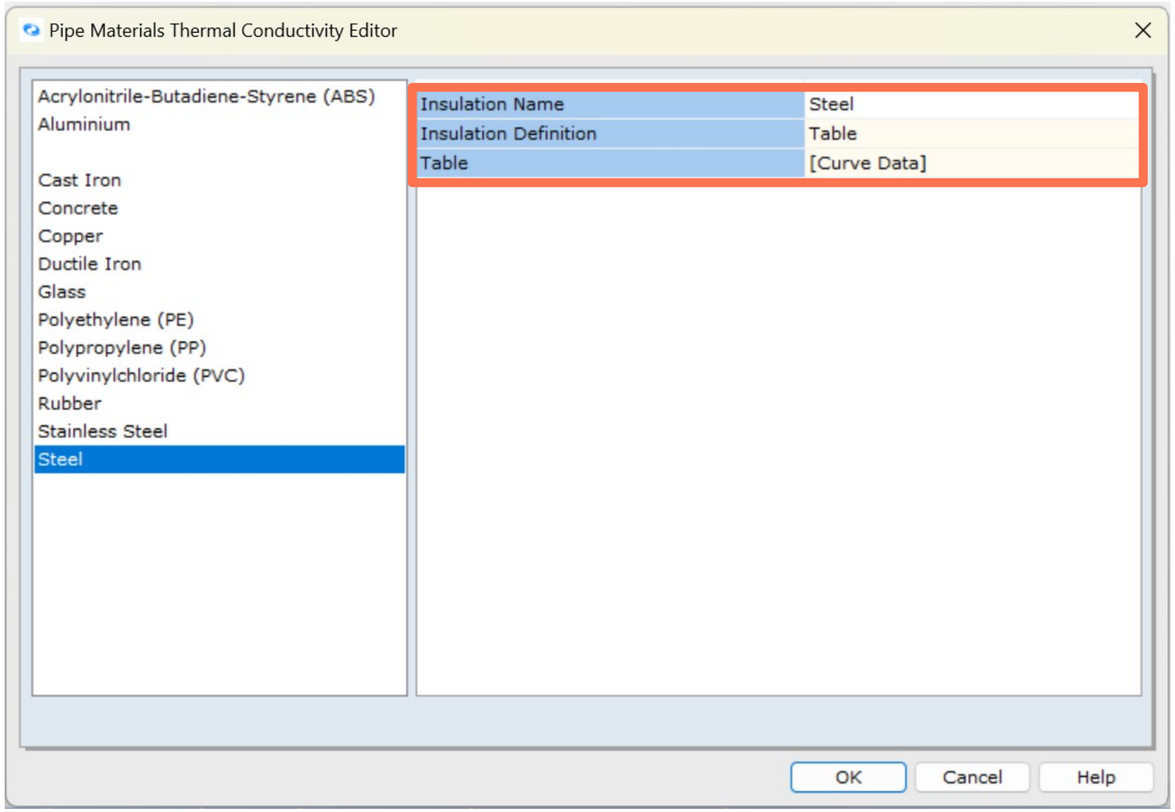
Pipe Materials Thermal Conductivity (Fixed Value)

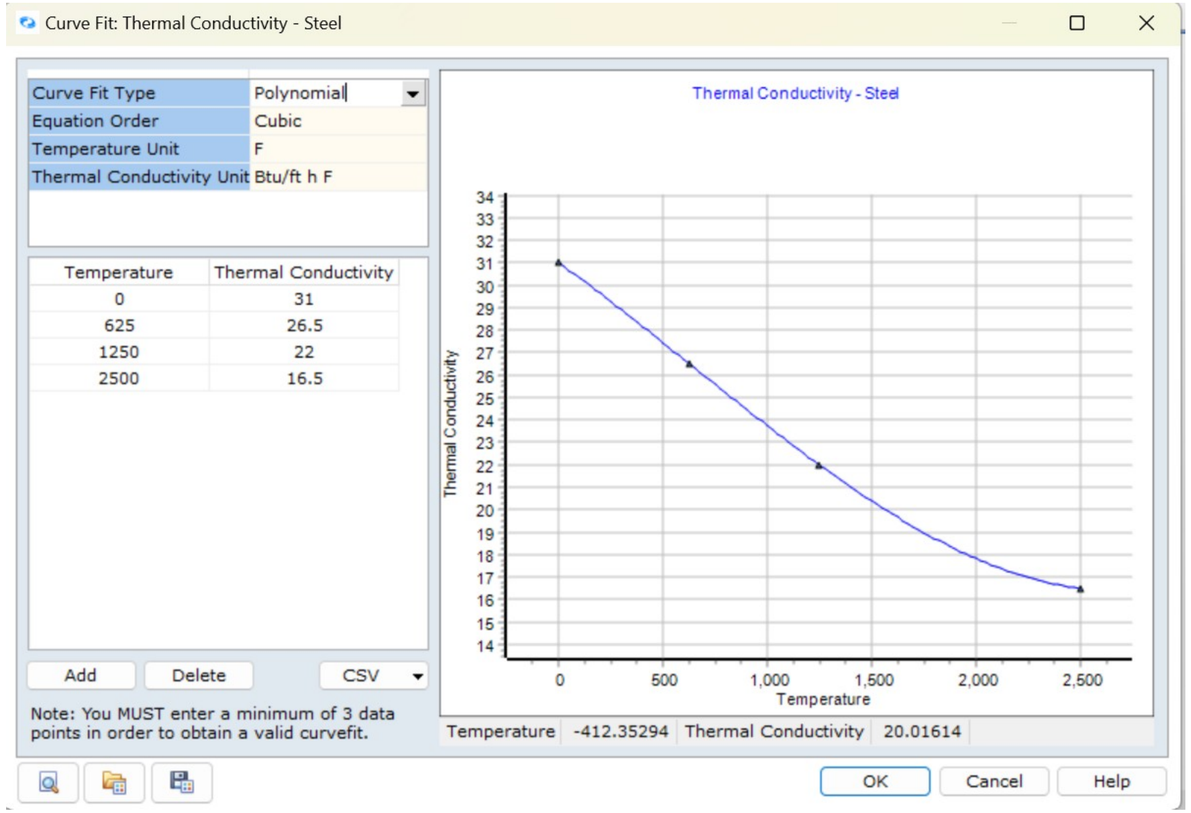




FluidFlow Database (Pipe & Insulation Properties)

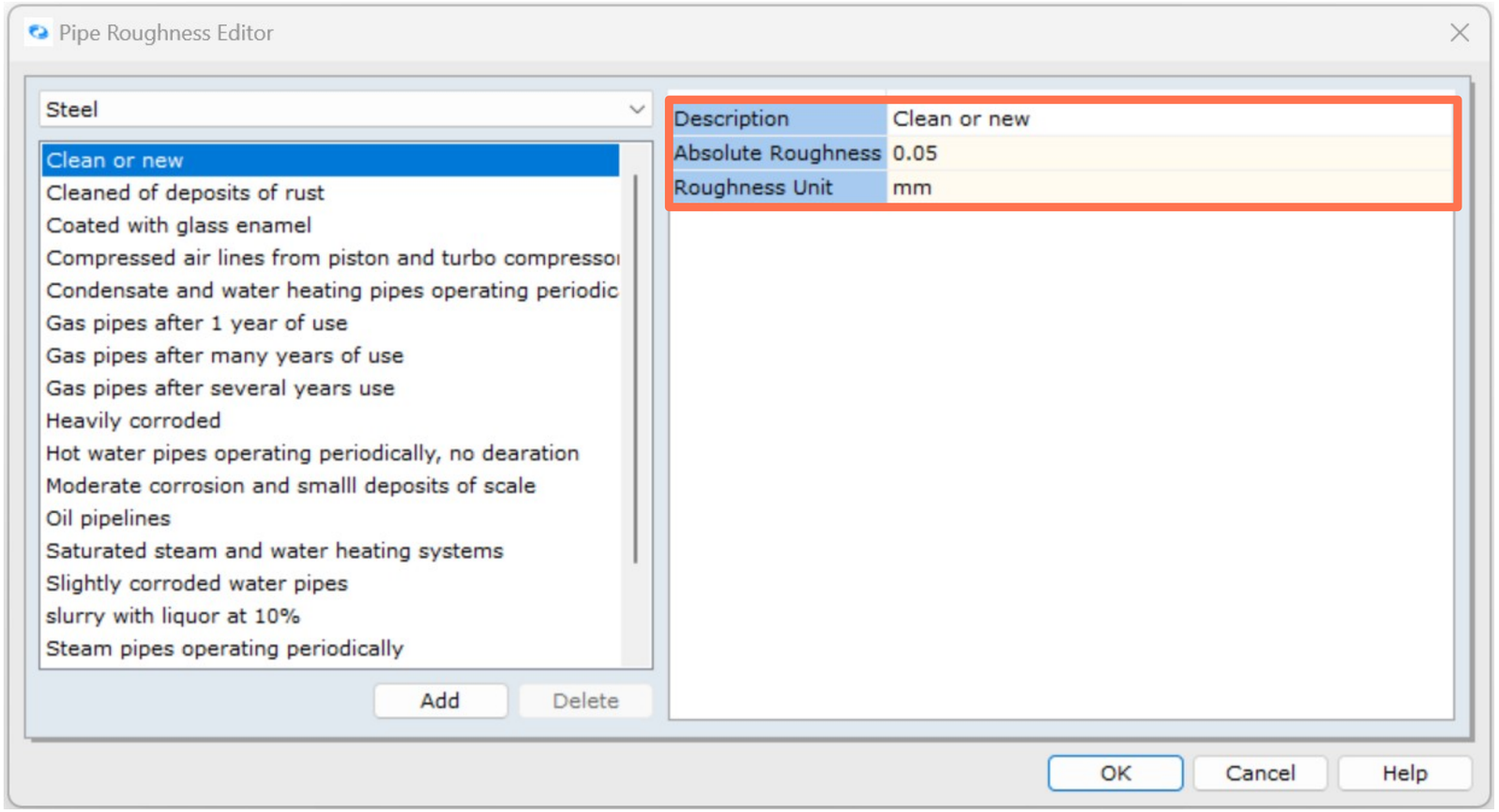
Pipe Materials Thermal Conductivity (Curve Data)

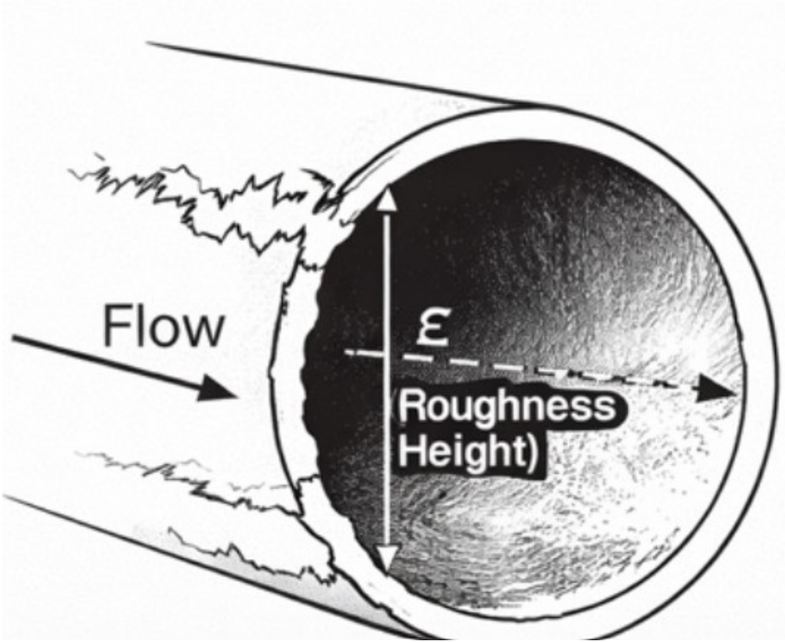




FluidFlow Database (Pipe & Insulation Properties)

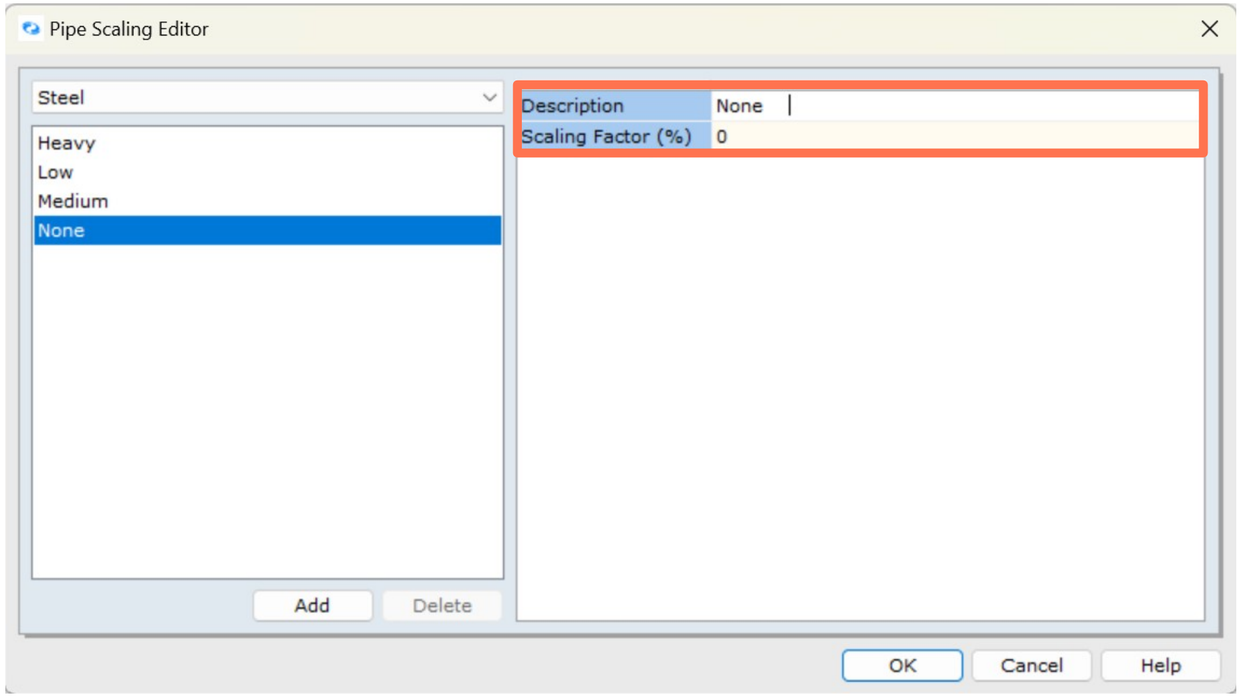
Pipe Roughness

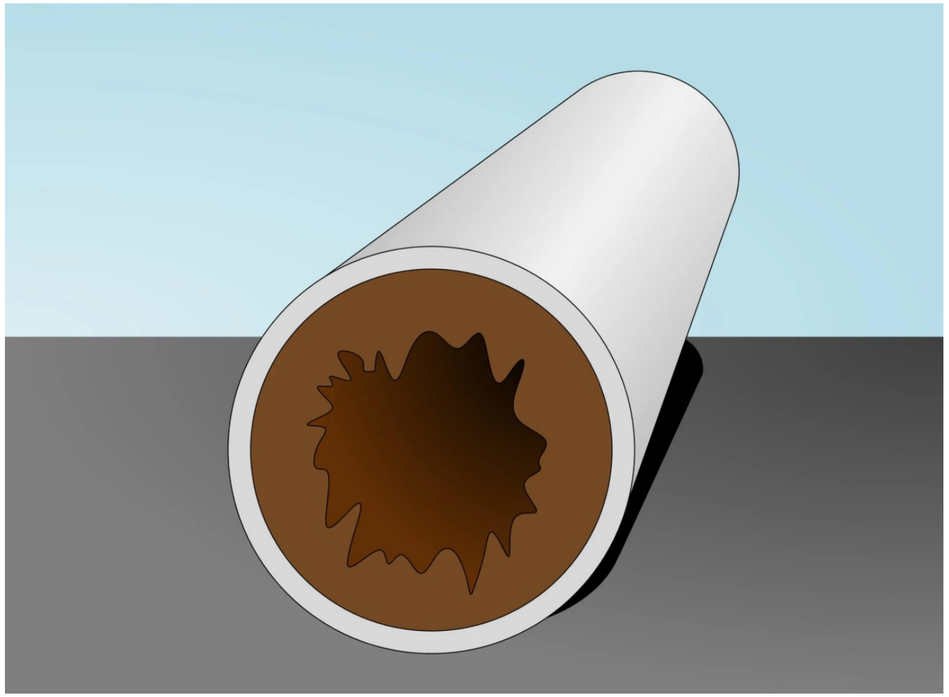




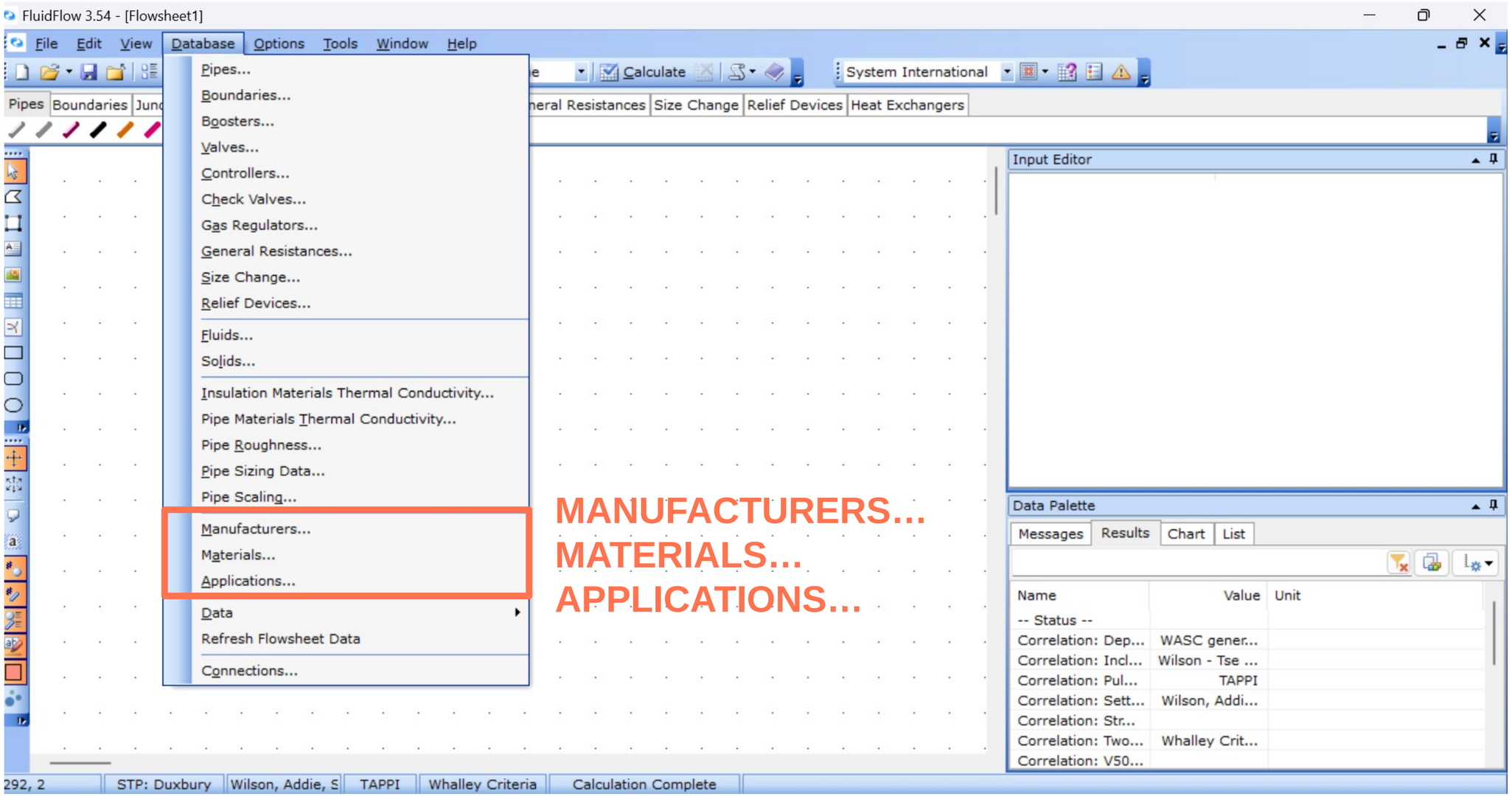
FluidFlow Database (Pipe & Insulation Properties)

Pipe Scaling



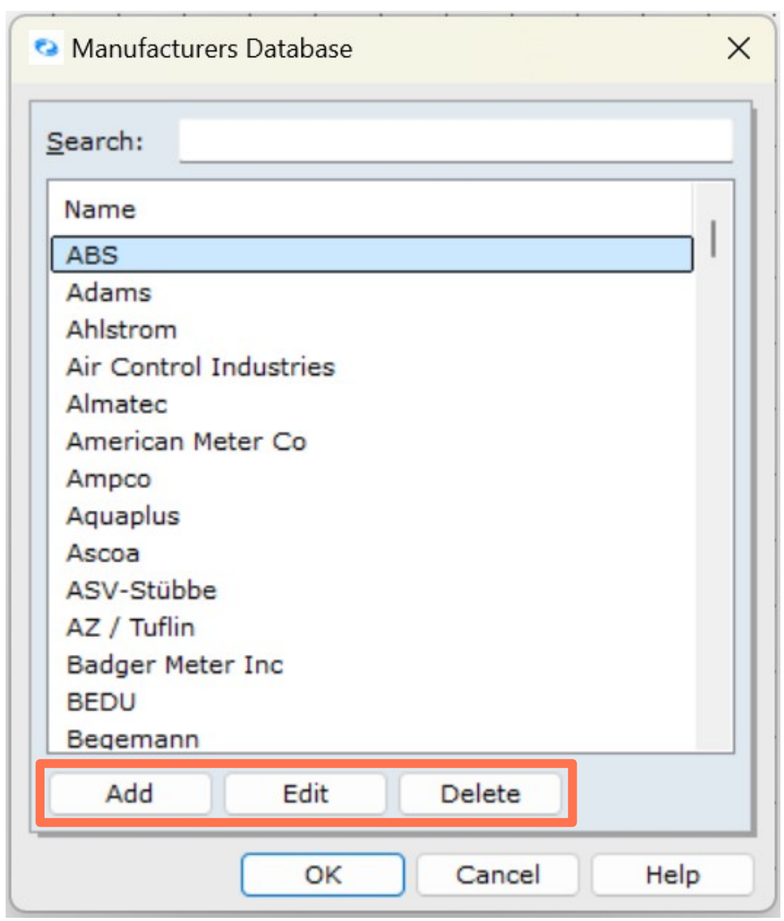


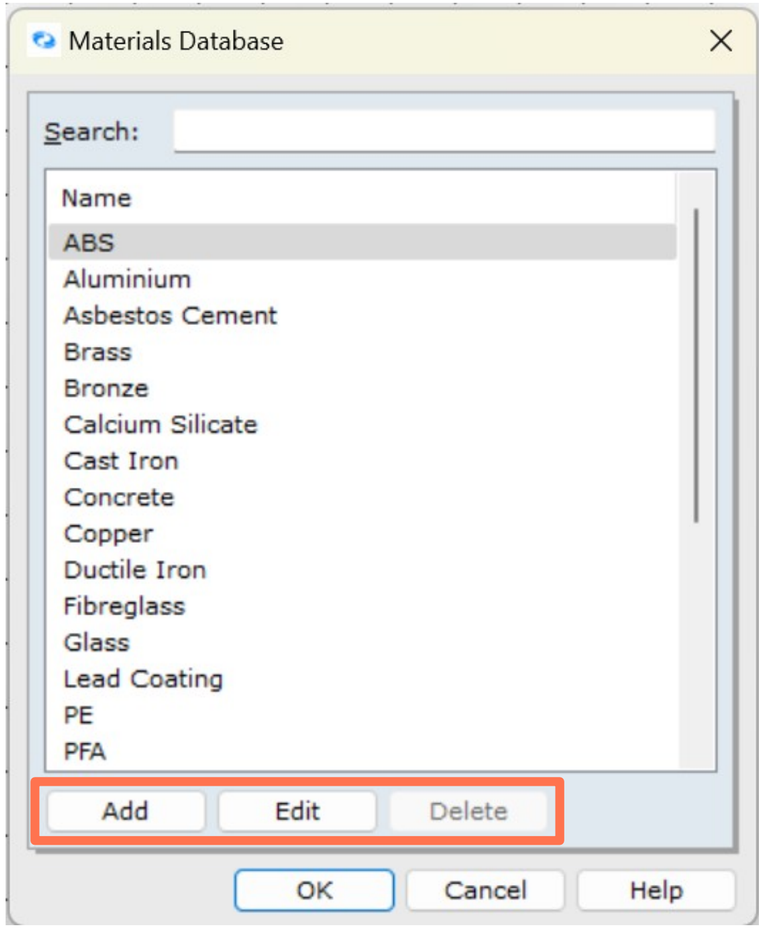
FluidFlow Database

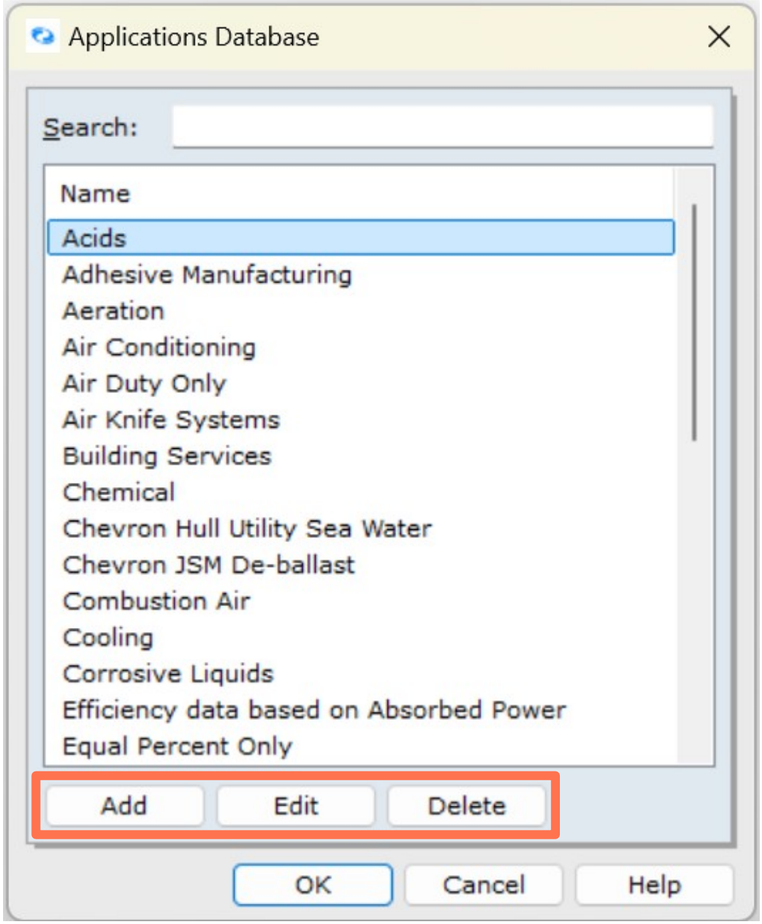


FluidFlow Database

Manufacturers, Materials, & Applications Database





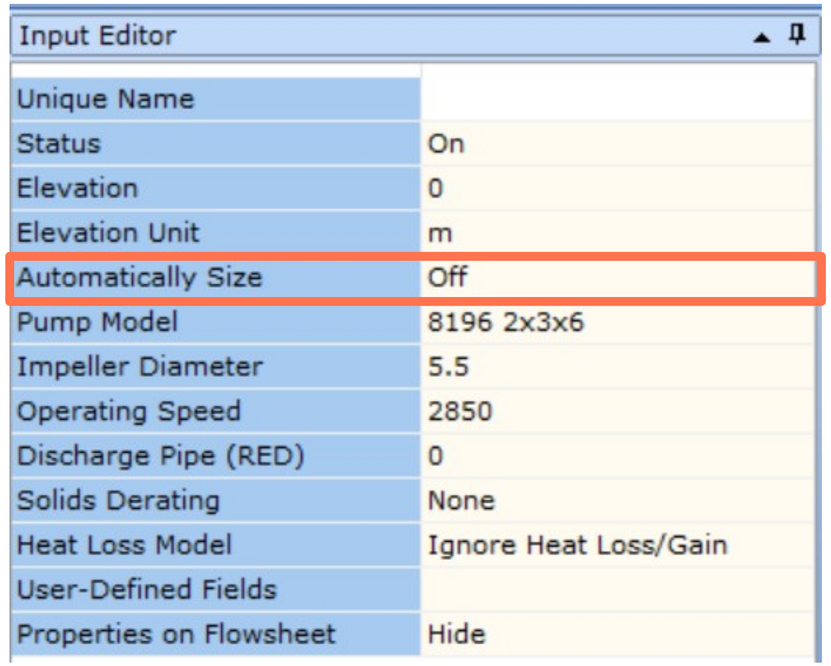


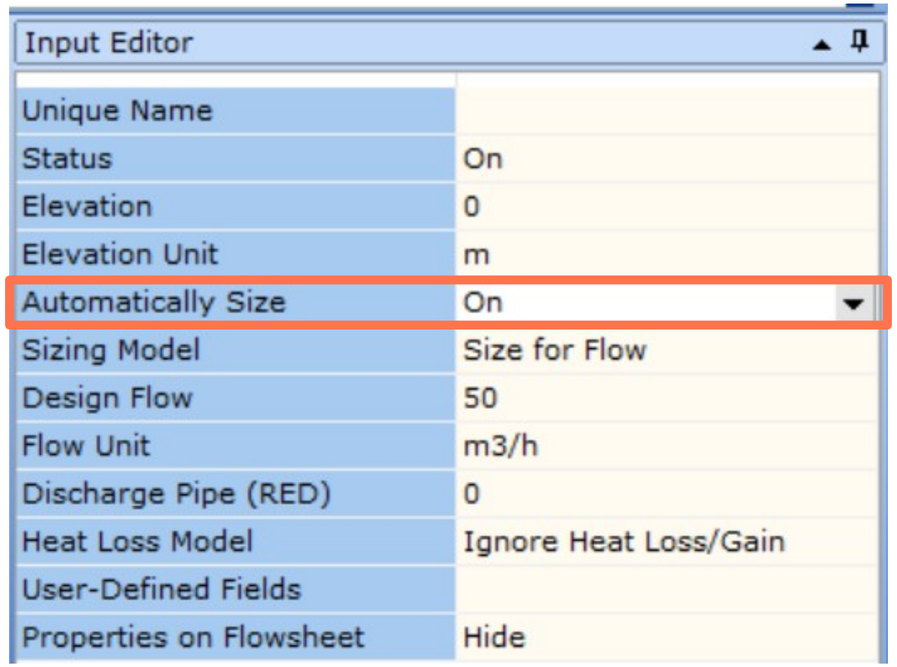
FLUIDFLOW DESIGN
AND RATING CASE MODE

FluidFlow Design and Rating Case Mode

Auto Size Feature

- Automatically Size: Set ***Off*** by default. When set to ***On***, **FluidFlow** allows engineers to auto-size the components





FluidFlow Design and Rating Case Mode

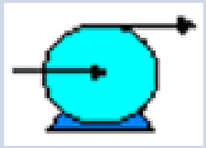
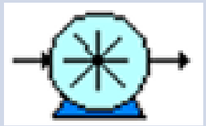
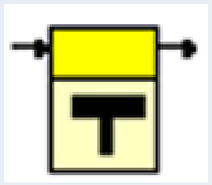
Auto Size Feature

- **Design (Auto-size On):** a **certain parameter (flow rate, pressure rise, pressure drop, etc.) is specified**, and the necessary **component/equipment is designed** such that the specification is met.

- **Rating (Auto-size Off):** the **component/equipment from vendor data is specified (it may be new or existing)** and the **performance is rated**.

FluidFlow Design and Rating Case Mode

Auto Size Feature

Object	Icon	Sizing Model	Solve For
Centrifugal Pump		Size for Flow	Duty Pressure Rise
		Size for Pressure Rise	Duty Flow
Rotating Positive Displacement Pump		Size for Flow	Duty Pressure Rise
Fan or Compressor		Size for Flow	Duty Pressure Rise
		Size for Pressure Rise	Duty Flow
Positive Displacement Pump or Compressor		Size for Flow	Duty Pressure Rise

FluidFlow Design and Rating Case Mode

Auto Size Feature

Object	Icon
Self Acting Pressure Reducer	
Self Acting Pressure Sustainer	
Self Acting Differential Pressure Controller	
Flow Control Valve	
Pressure Control Valve	

- Autosizing Controllers solves for the Control Valve Cv
- Pressure variable for controllers are at static pressure

FluidFlow Design and Rating Case Mode

Auto Size Feature

Object	Icon	Sizing Model	Solve For
Thin Orifice		Size for Flow	Bore Size
		Size for Pressure Loss	
Thick Orifice		Size for Flow	
		Size for Pressure Loss	
Inline Nozzle		Size for Flow	Throat Size
		Size for Pressure Loss	
Venturi Tube		Size for Flow	
		Size for Pressure Loss	

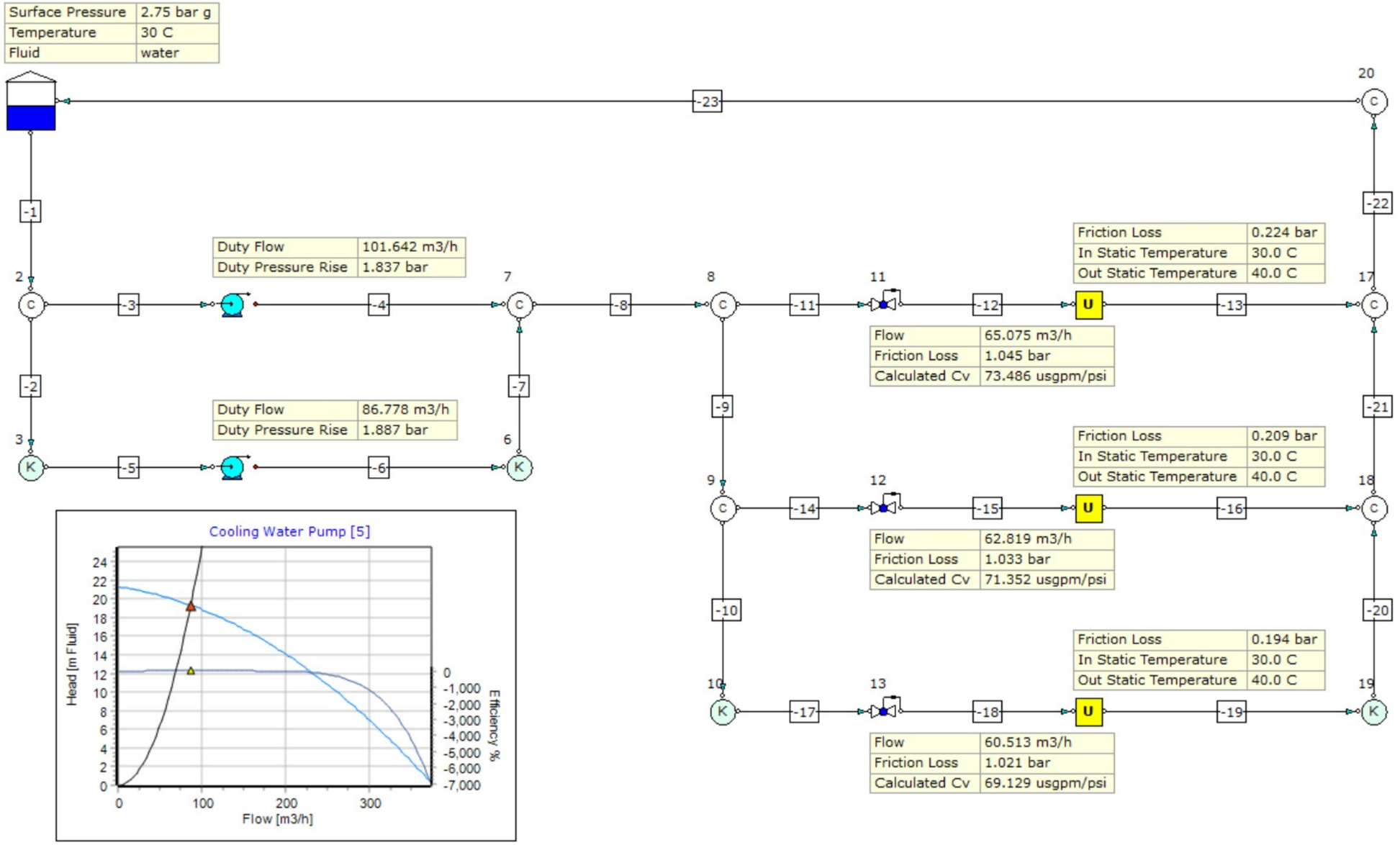
FluidFlow Design and Rating Case Mode

Auto Size Feature

Object	Icon	Pressure Loss Model	Solve For
Relief Valve		API RP520 Part 1	Orifice Size
		ISO 4126 - 1	

FLUIDFLOW DEMO
WITH PUMP DATABASE

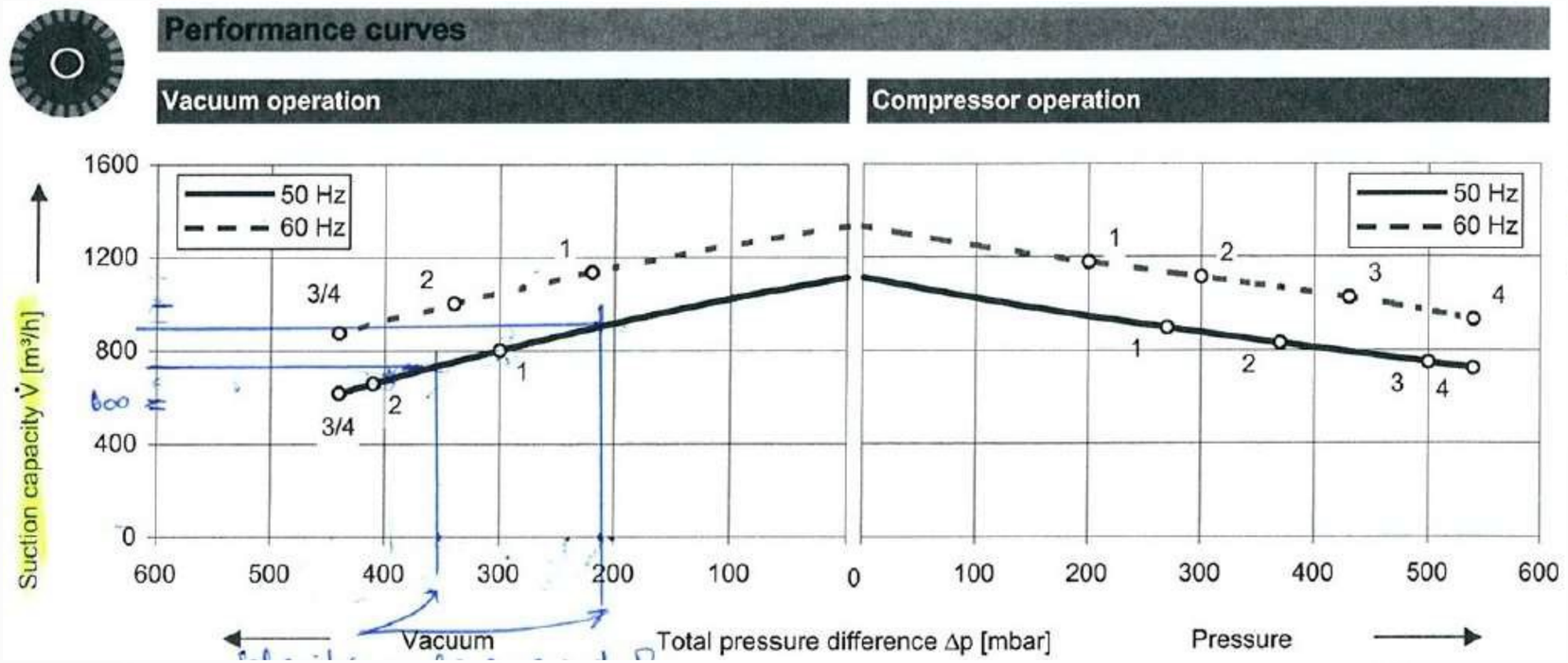
FluidFlow Rating Case Mode



FLUIDFLOW DEMO
WITH VACUUM PUMP DATABASE

Vacuum System

This is an example technical query received from a customer who was having difficulty modeling a **vacuum pump**.
Below is a screenshot of the vacuum pump performance details.



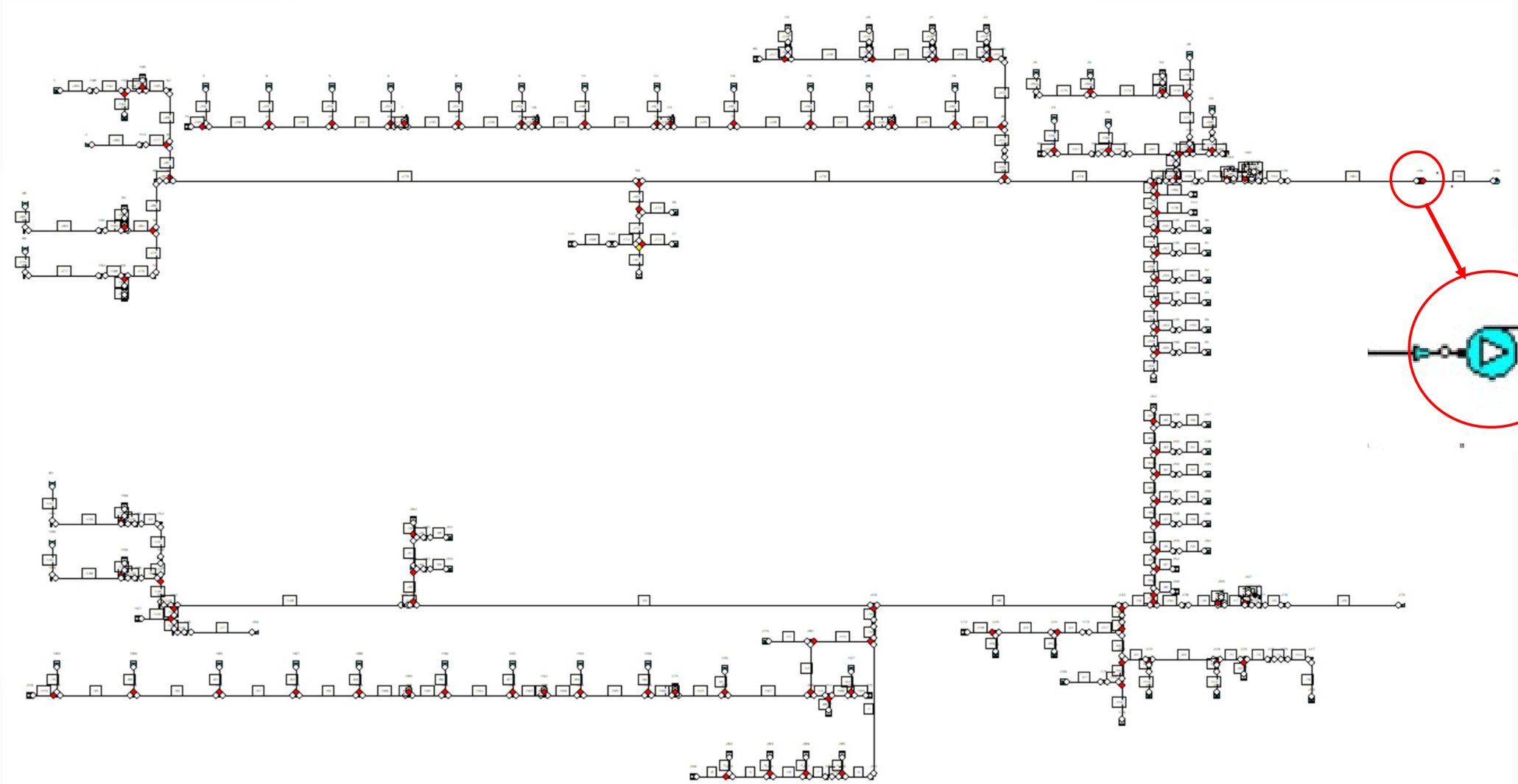
The performance curves are based on air at a temperature of 15 °C and an atmospheric pressure of 1013 mbar with a tolerance of ± 10 %. The total pressure differences are valid for suction and ambient temperature up to 25 °C. For other conditions please get in touch wit h us.

Vacuum System

Capacity Curve Data

Flow (m3/h)	Pressure (mbar)
1120	0
1050	100
900	200
800	300
700	400
600	500

Vacuum System



FLUIDFLOW MODULES

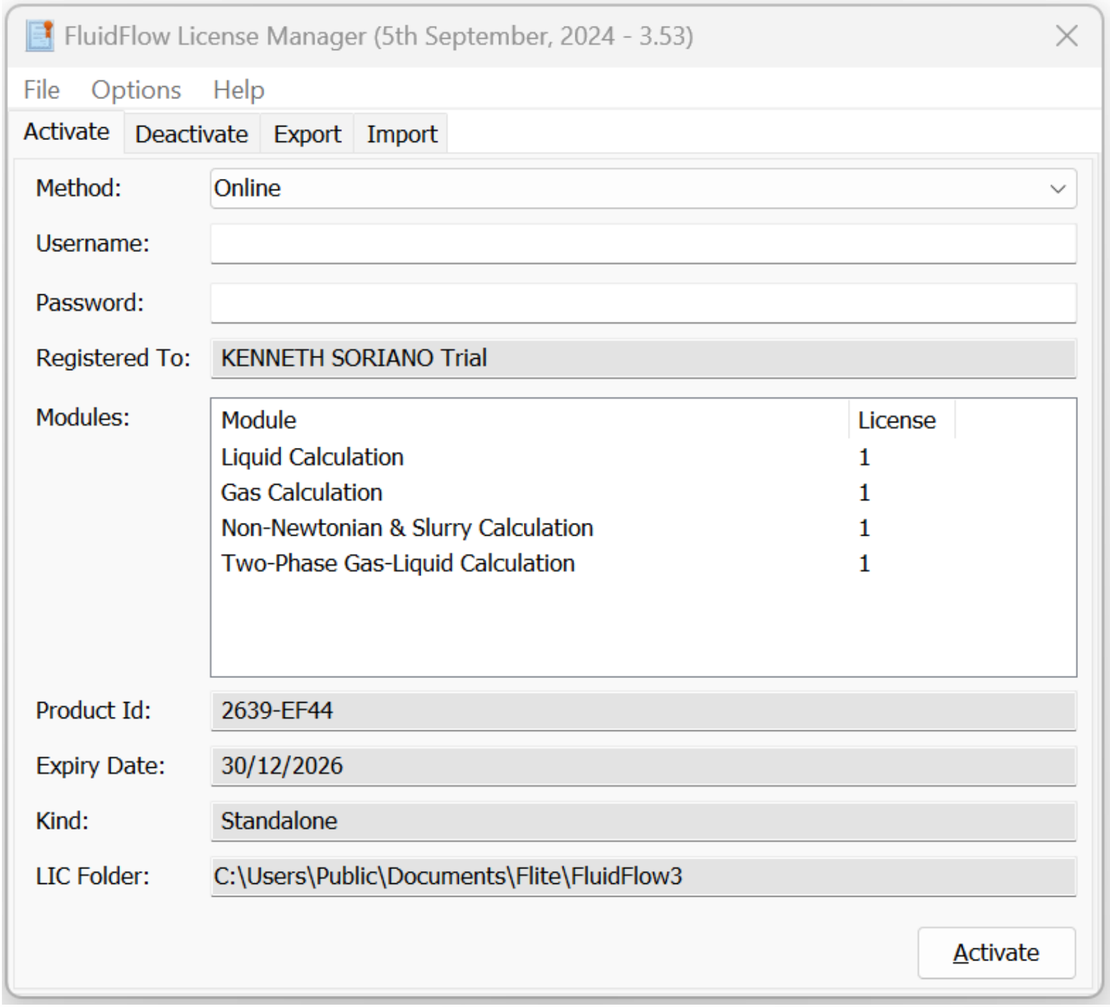
FluidFlow Modules

Liquid

Gas

Slurry

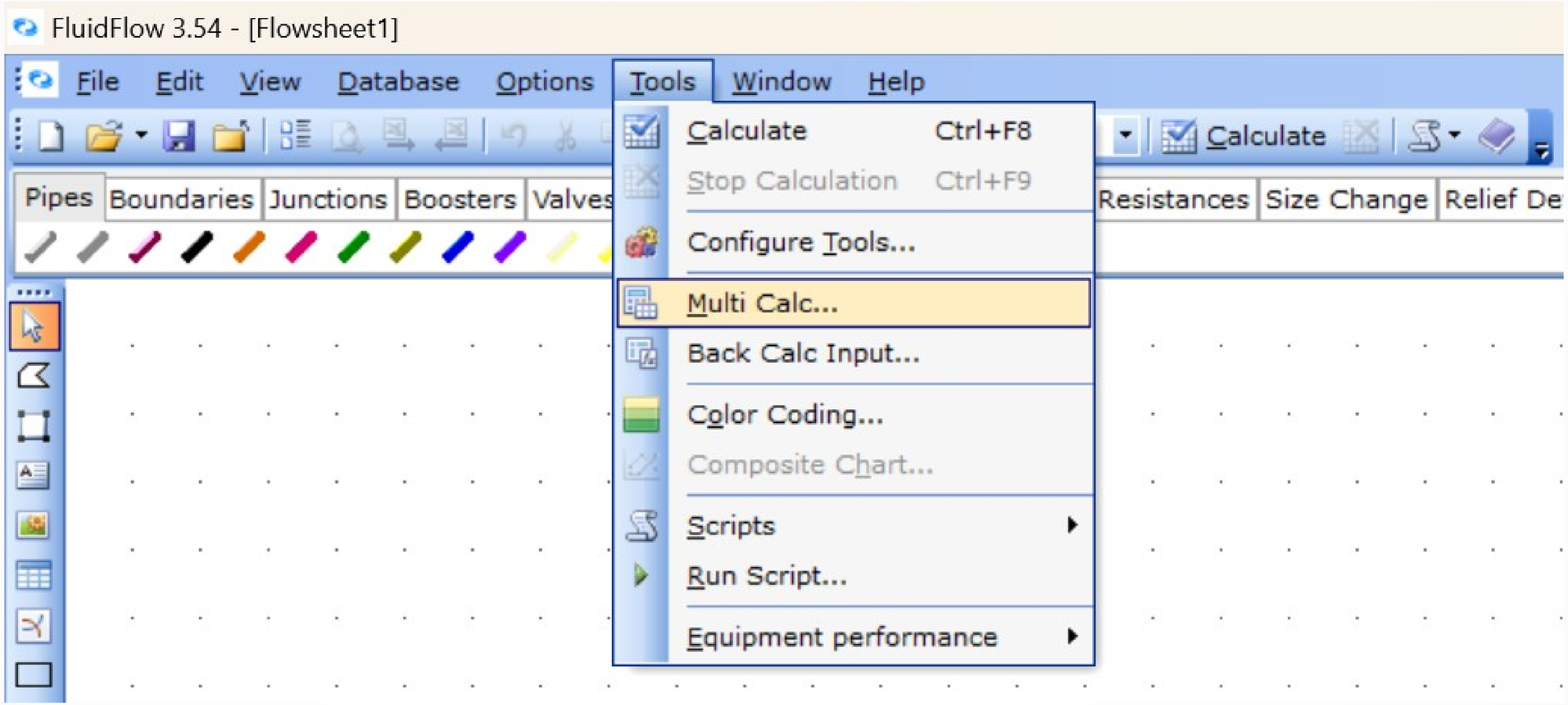
Two Phase Flow



FLUIDFLOW
SPECIAL FEATURES

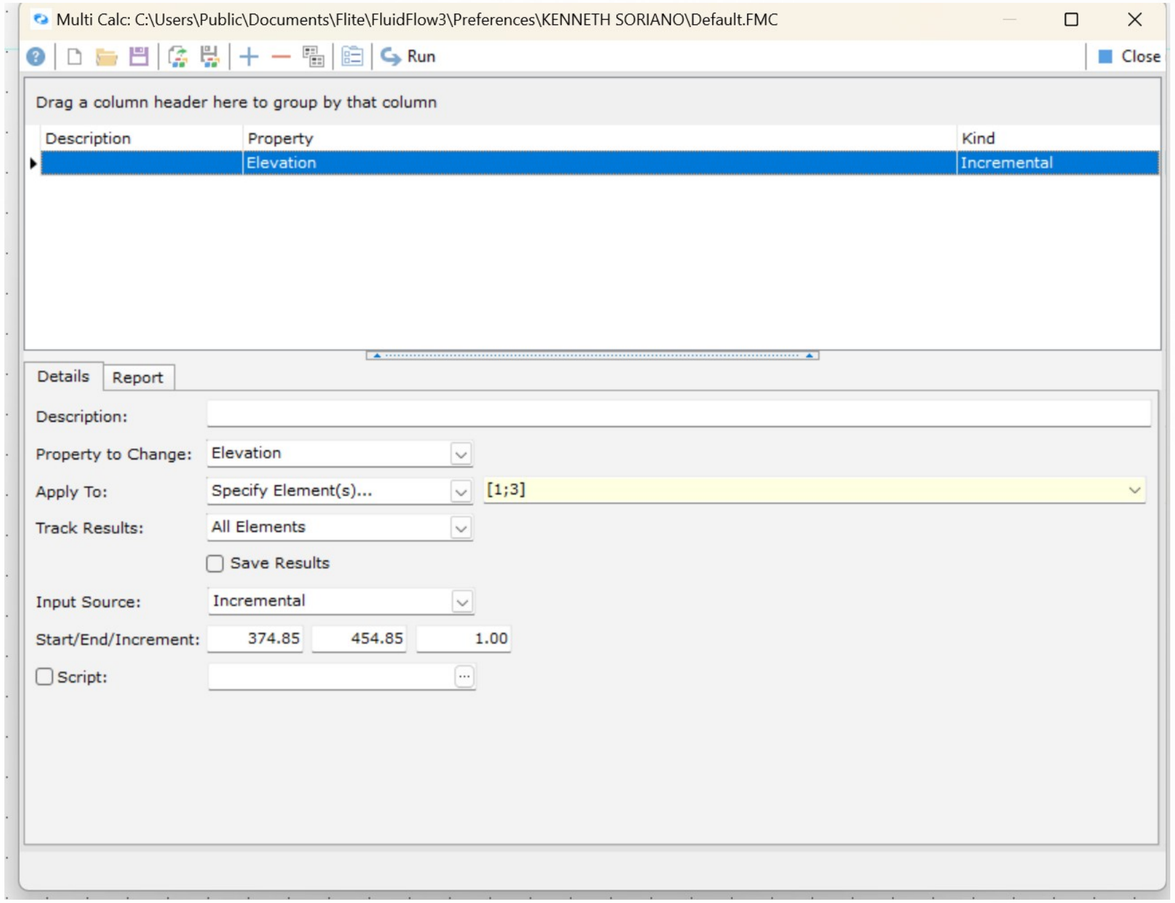
FluidFlow Special Features

❑ Multi Calc



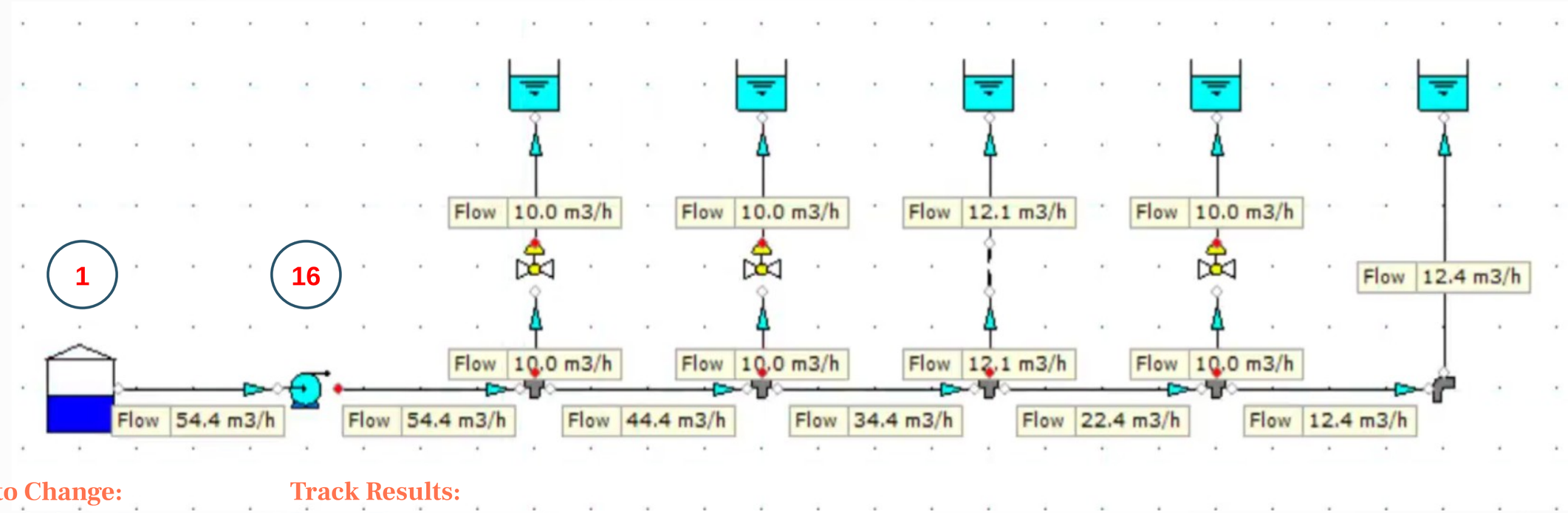
FluidFlow Special Features

❑ Multi Calc



FluidFlow Special Features

❑ Multi Calc



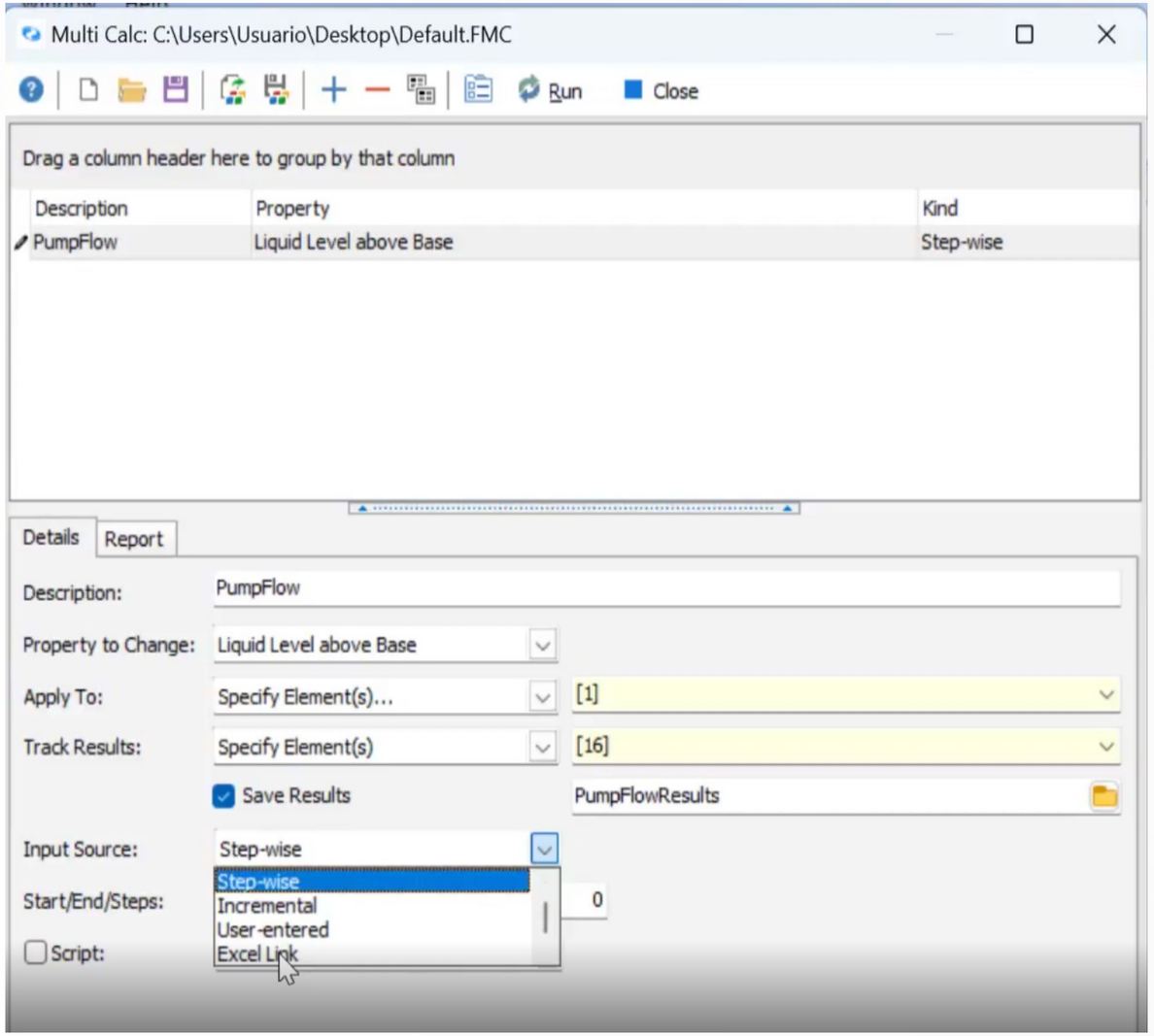
Property to Change:
Liquid Level Above Base Of the Reservoir

Track Results:
Pump Flow

FluidFlow Special Features

❑ Multi Calc

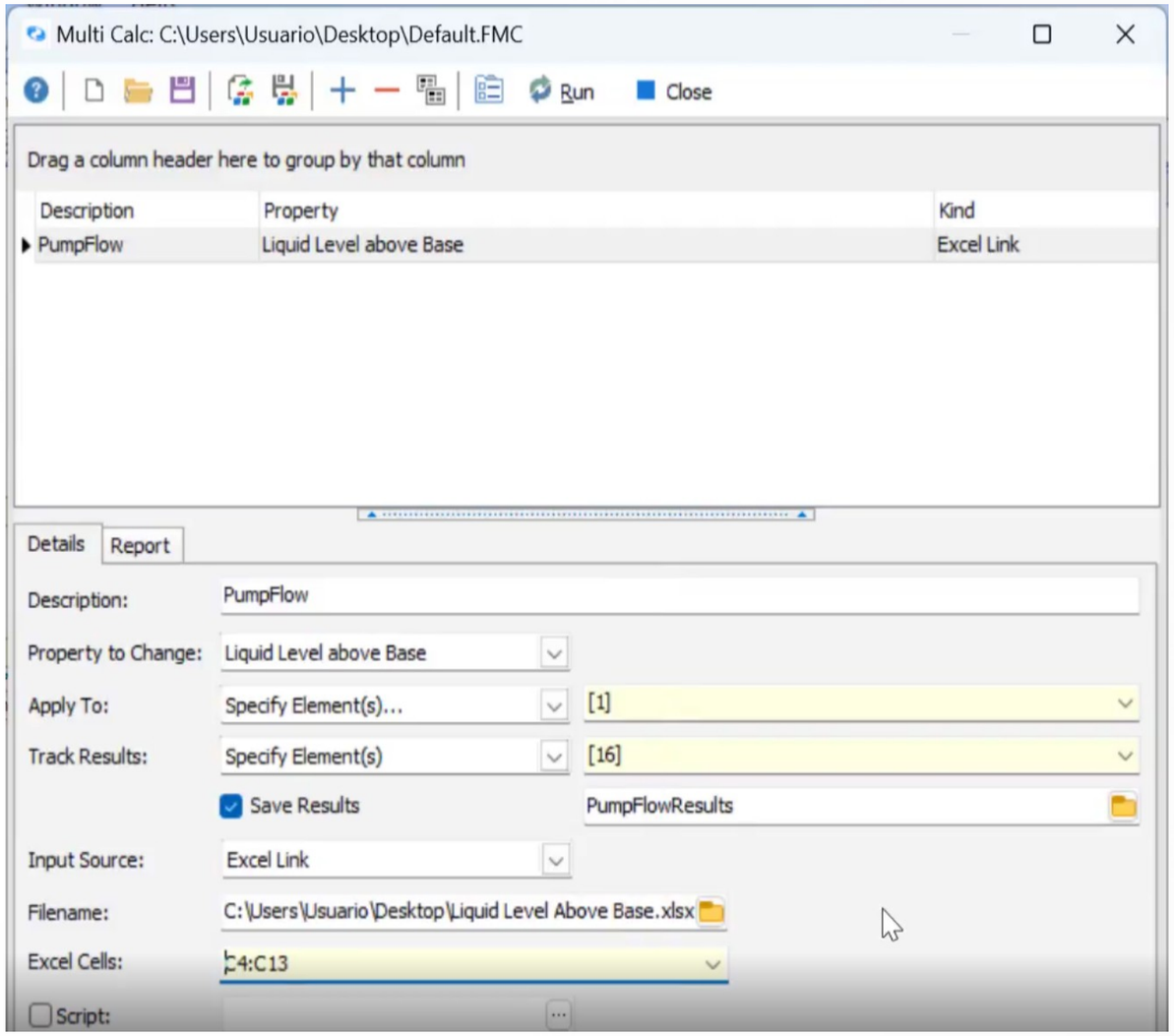
a) Step wise
b) Incremental
c) User-Entered
d) Excel Link



FluidFlow Special Features

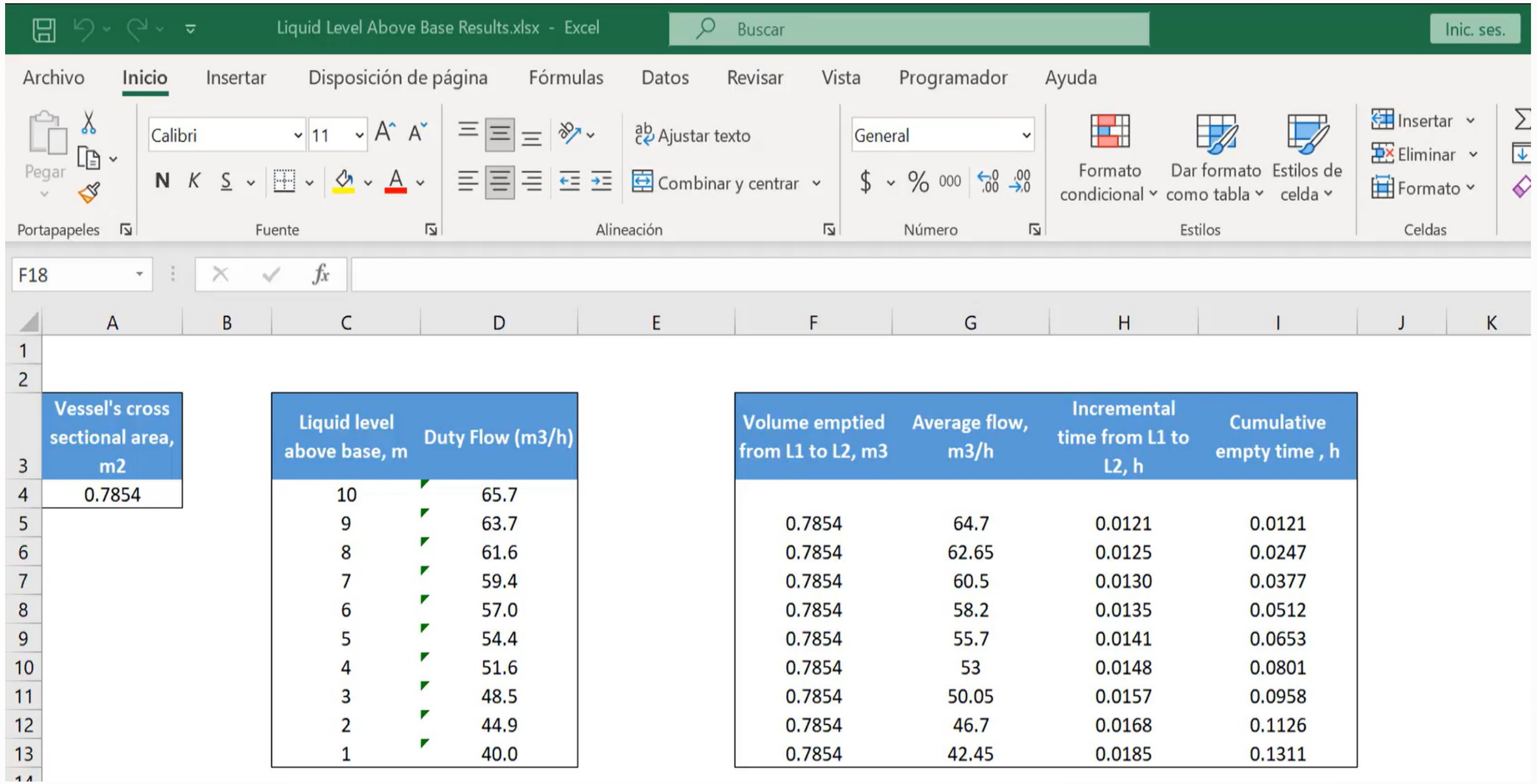
❑ Multi Calc

a) Step wise
b) Incremental
c) User-Entered
d) Excel Link



FluidFlow Special Features

❑ Multi Calc



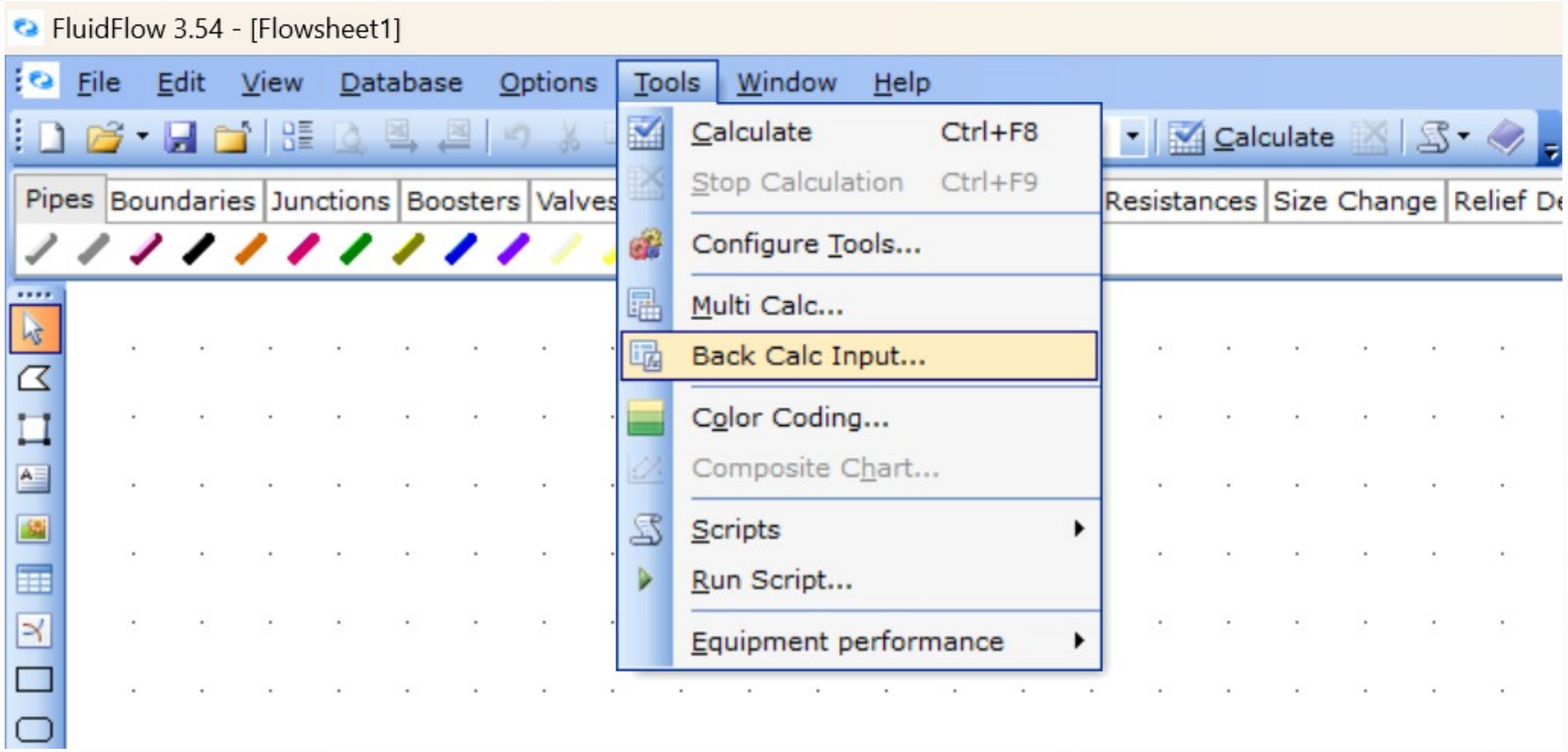
Vessel's cross sectional area, m2
0.7854

Liquid level above base, m	Duty Flow (m3/h)
10	65.7
9	63.7
8	61.6
7	59.4
6	57.0
5	54.4
4	51.6
3	48.5
2	44.9
1	40.0

Volume emptied from L1 to L2, m3	Average flow, m3/h	Incremental time from L1 to L2, h	Cumulative empty time , h
0.7854	64.7	0.0121	0.0121
0.7854	62.65	0.0125	0.0247
0.7854	60.5	0.0130	0.0377
0.7854	58.2	0.0135	0.0512
0.7854	55.7	0.0141	0.0653
0.7854	53	0.0148	0.0801
0.7854	50.05	0.0157	0.0958
0.7854	46.7	0.0168	0.1126
0.7854	42.45	0.0185	0.1311

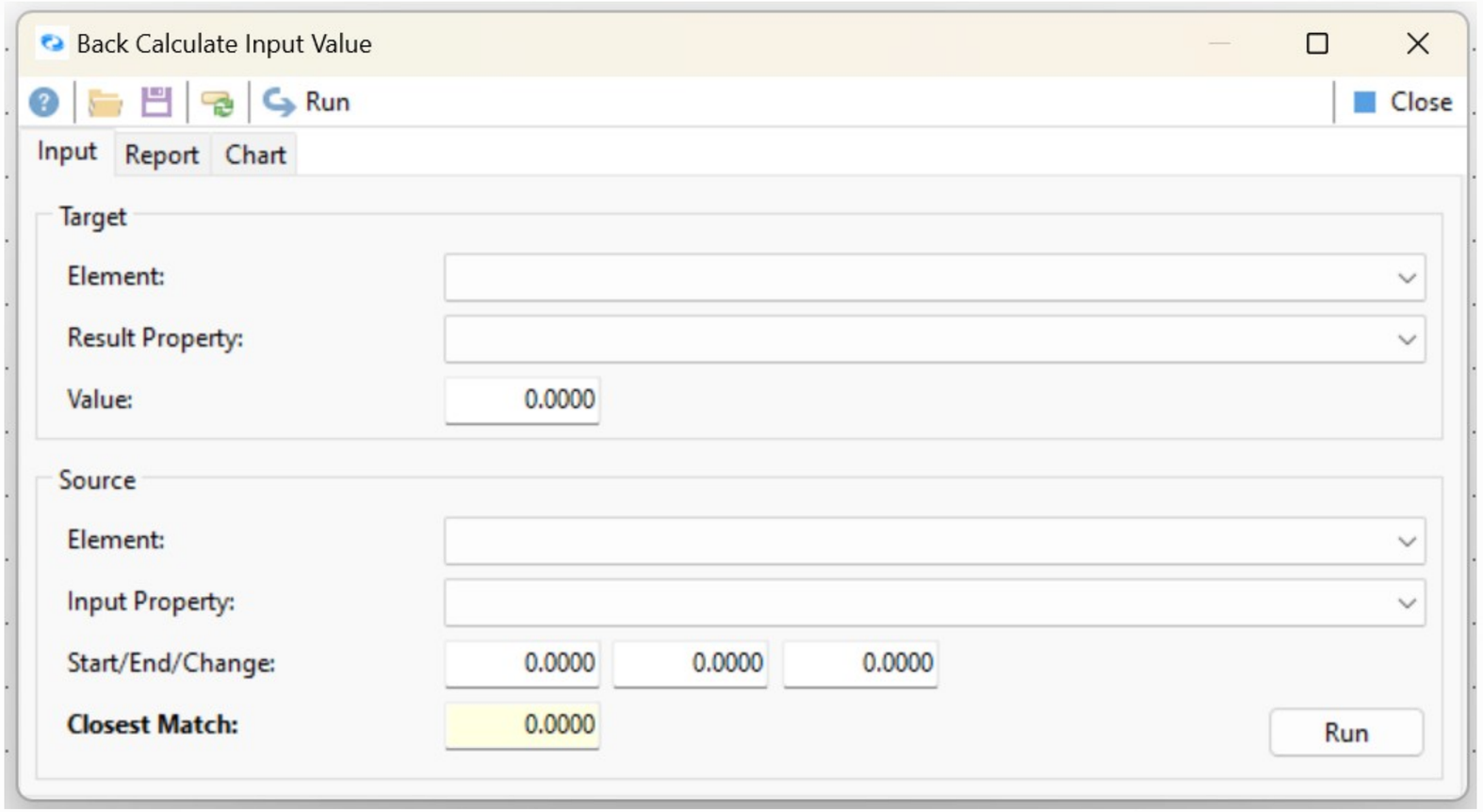
FluidFlow Special Features

❑ Back Calc



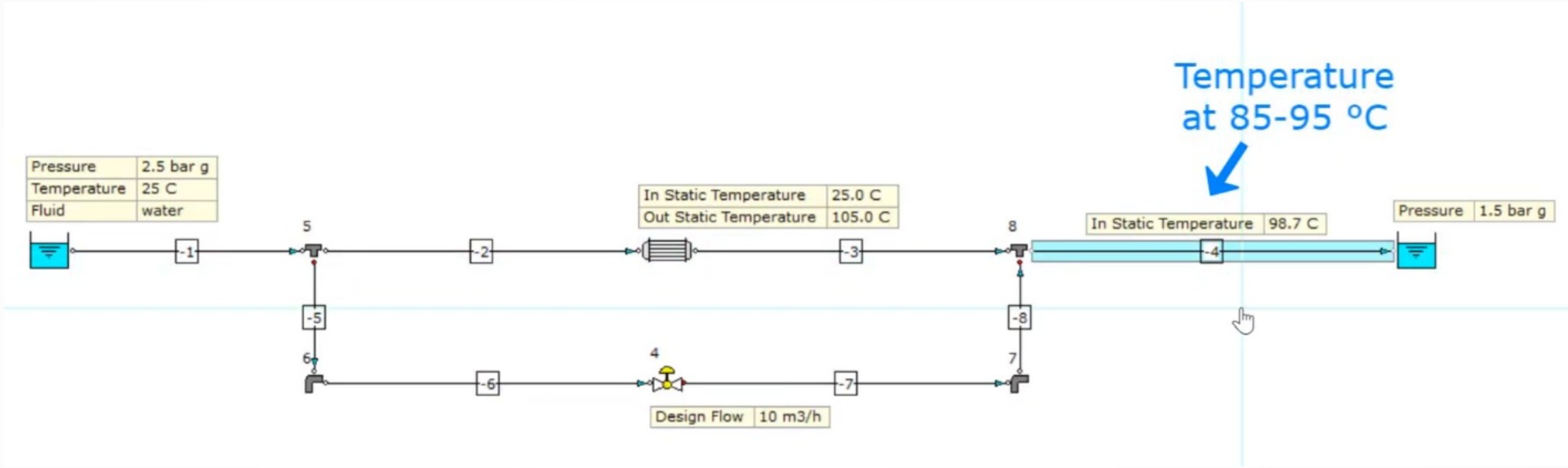
FluidFlow Special Features

❑ Back Calc



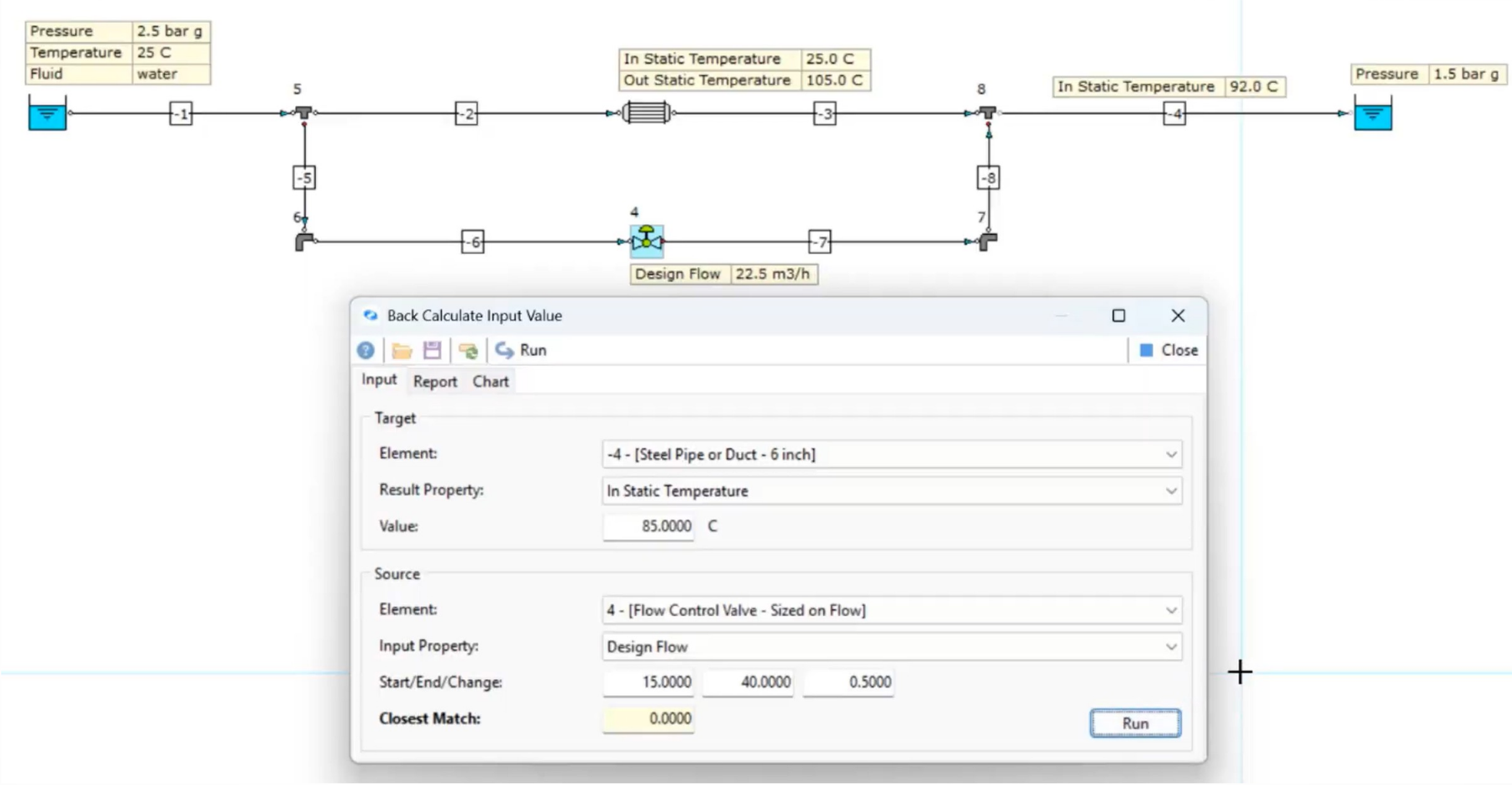
FluidFlow Special Features

❑ Back Calc



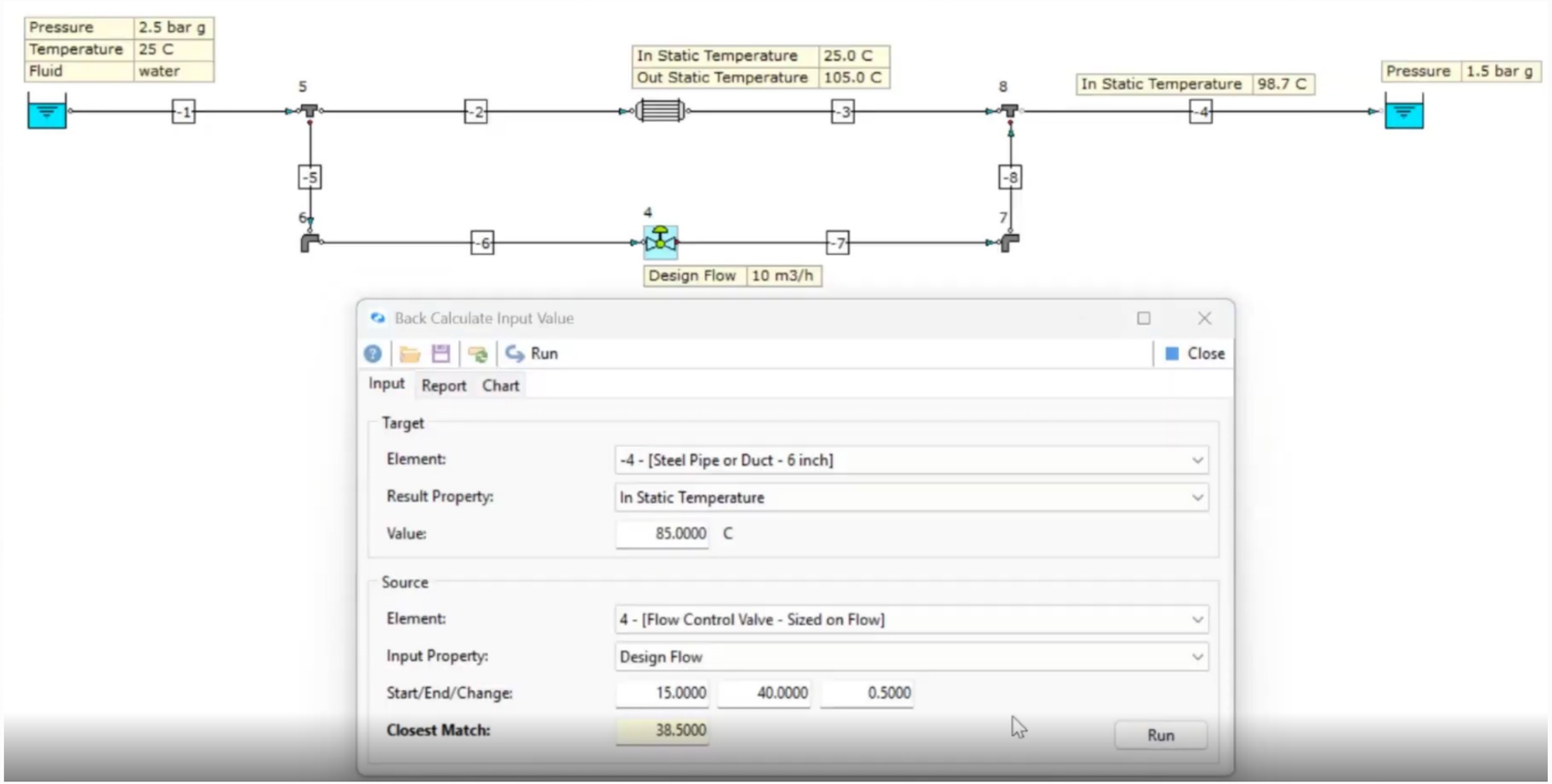
FluidFlow Special Features

❑ Back Calc



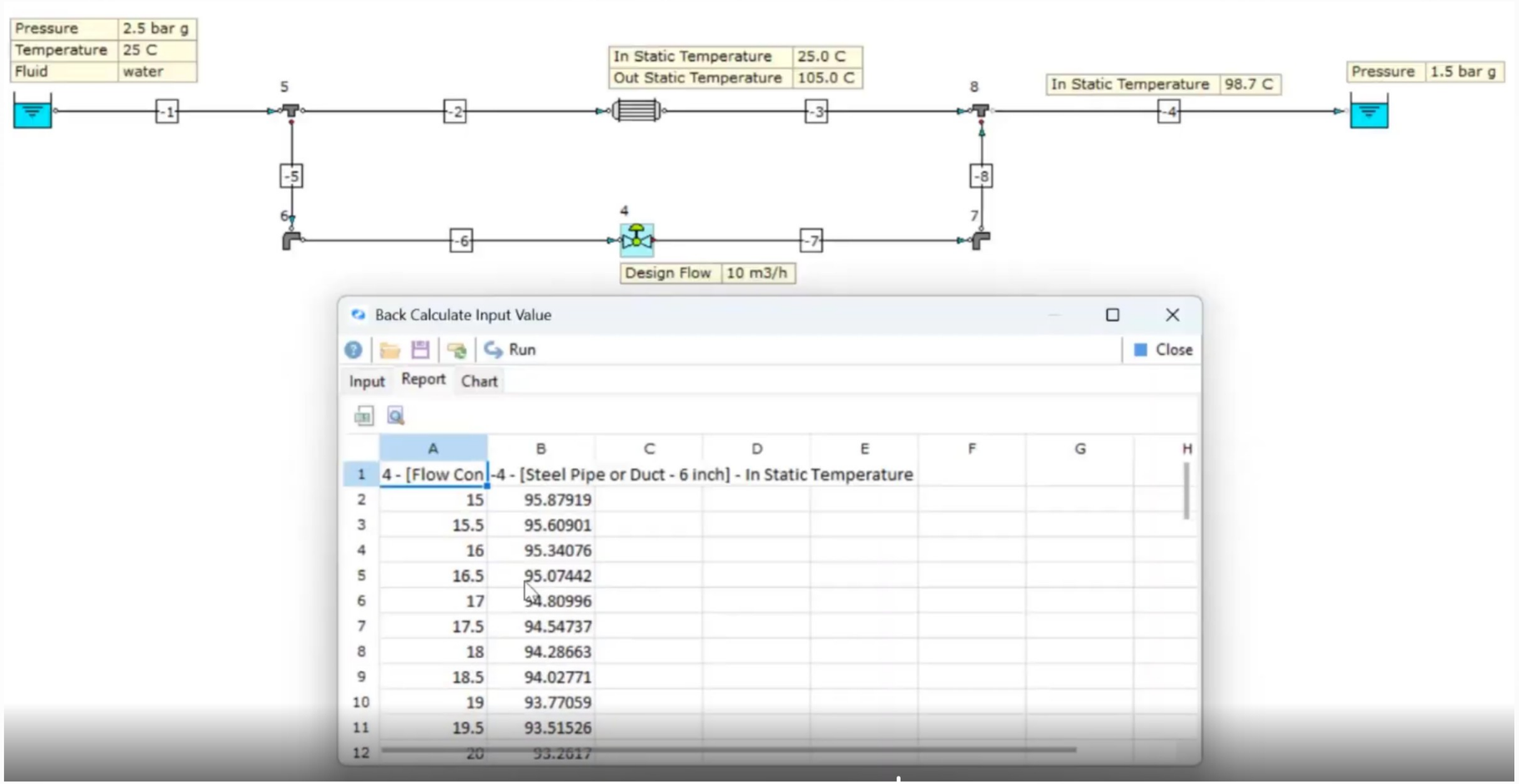
FluidFlow Special Features

❑ Back Calc



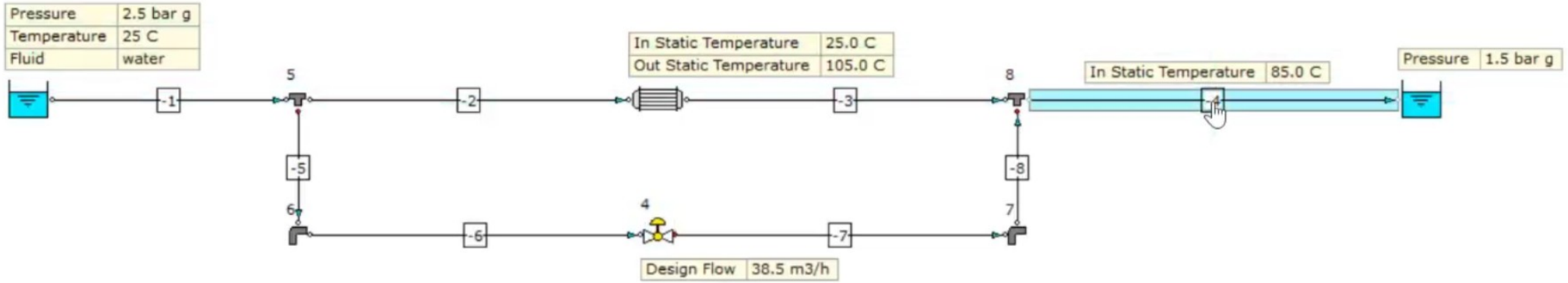
FluidFlow Special Features

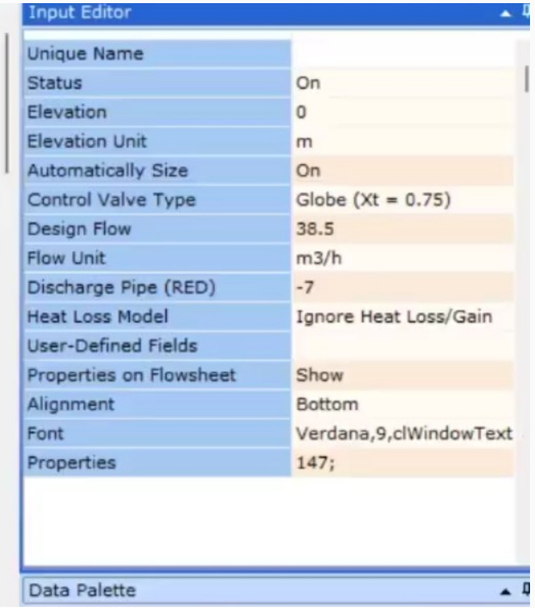
❑ Back Calc



FluidFlow Special Features

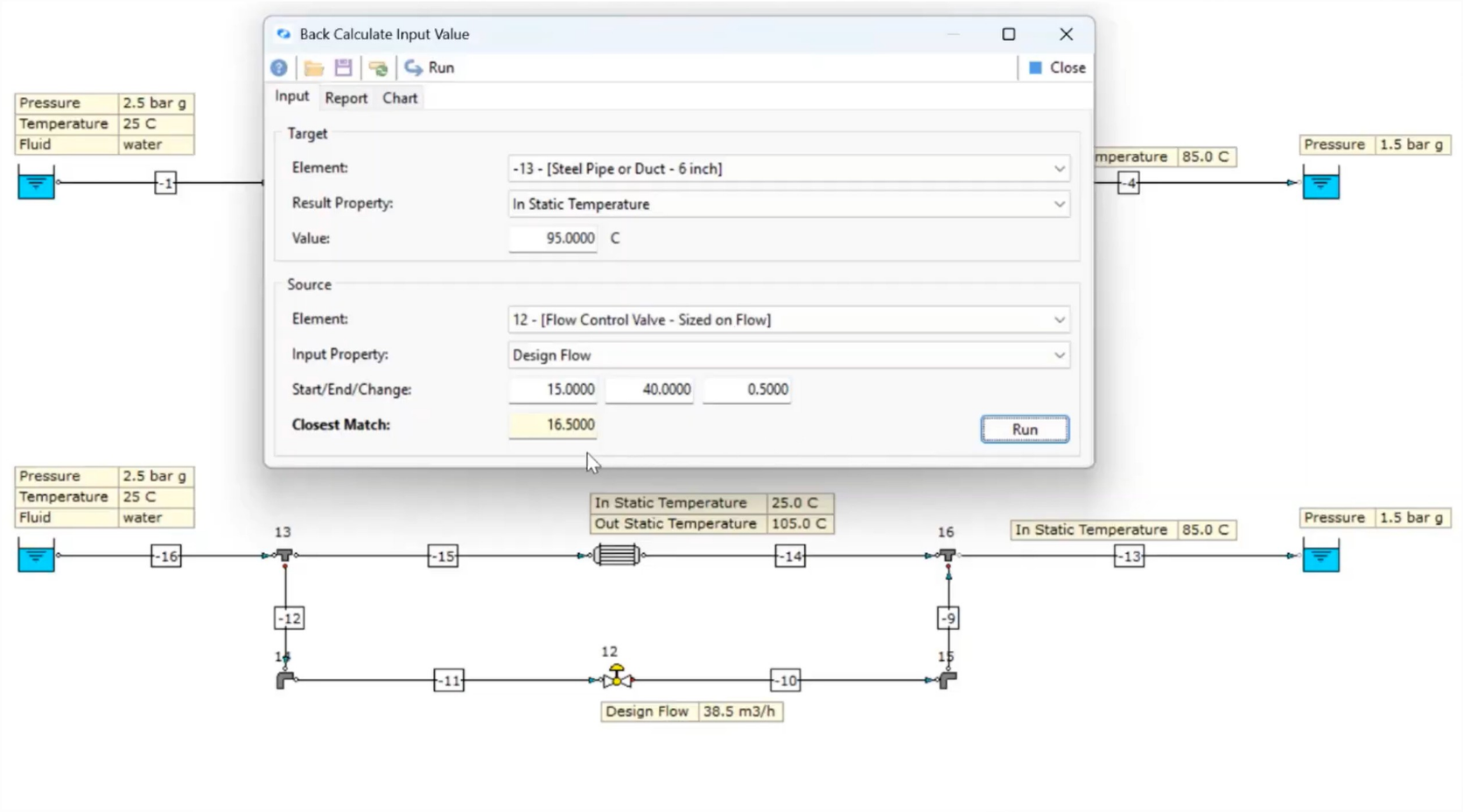
❑ Back Calc





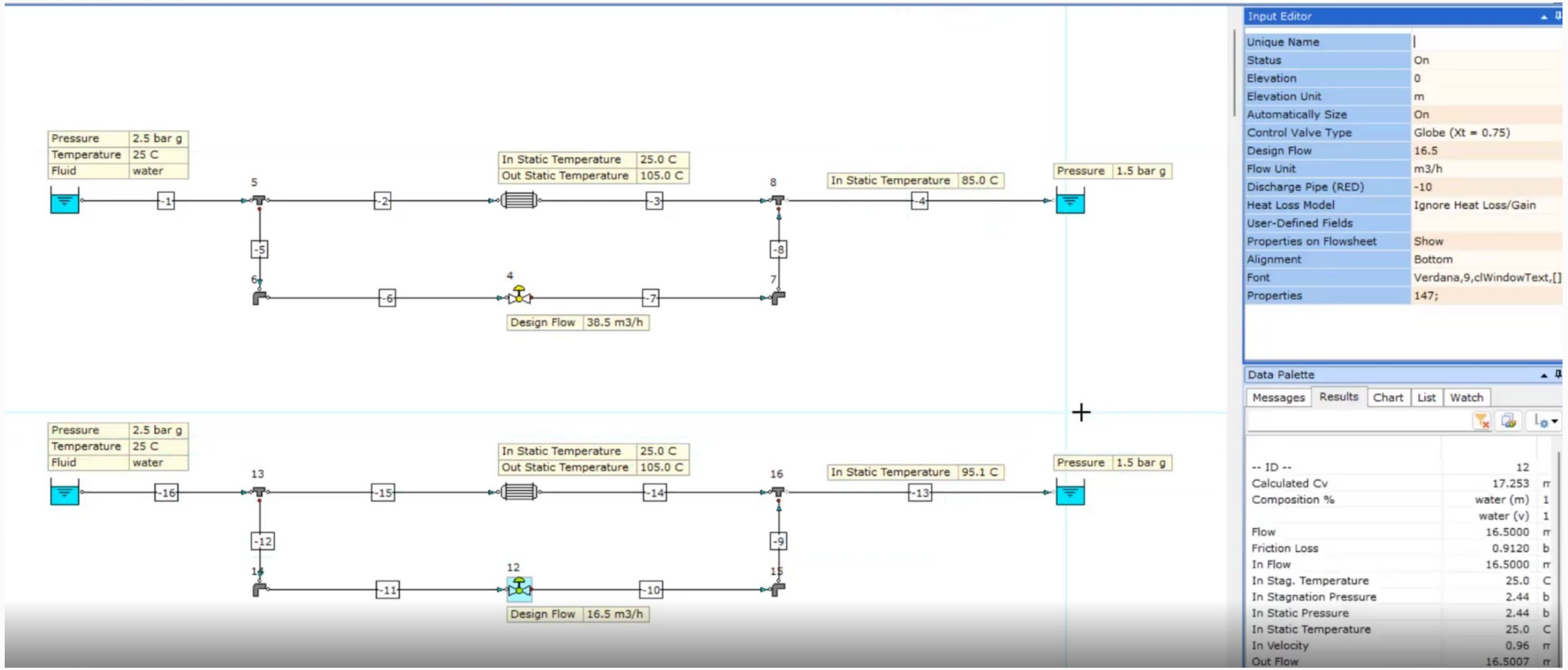
FluidFlow Special Features

❑ Back Calc



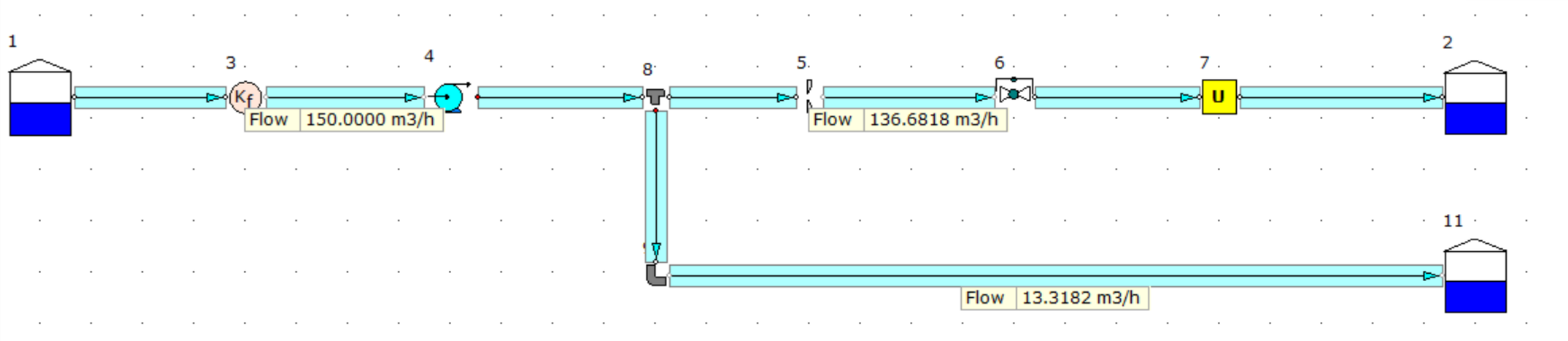
FluidFlow Special Features

❑ Back Calc



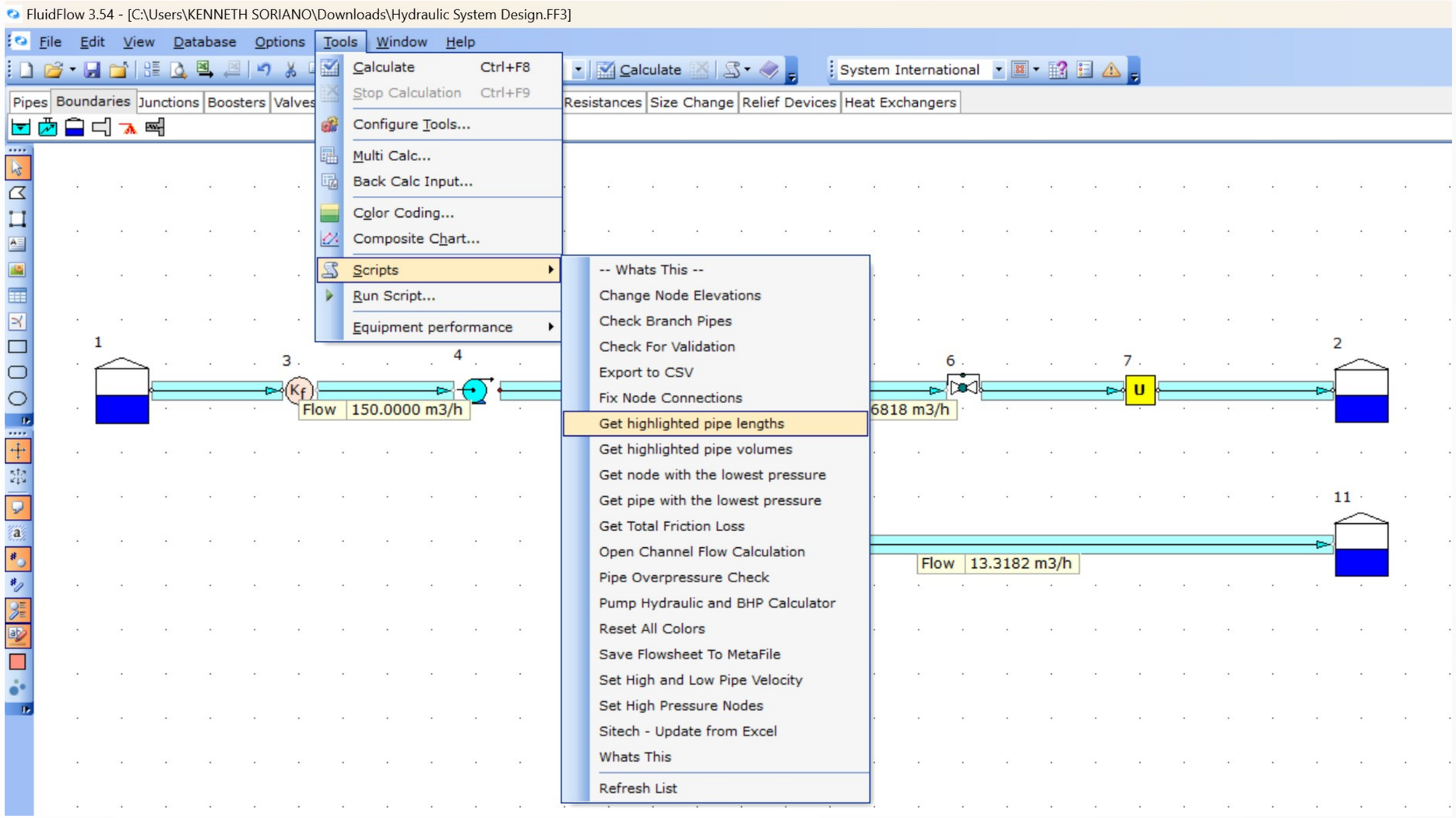
FluidFlow Special Features

❑ Scripts



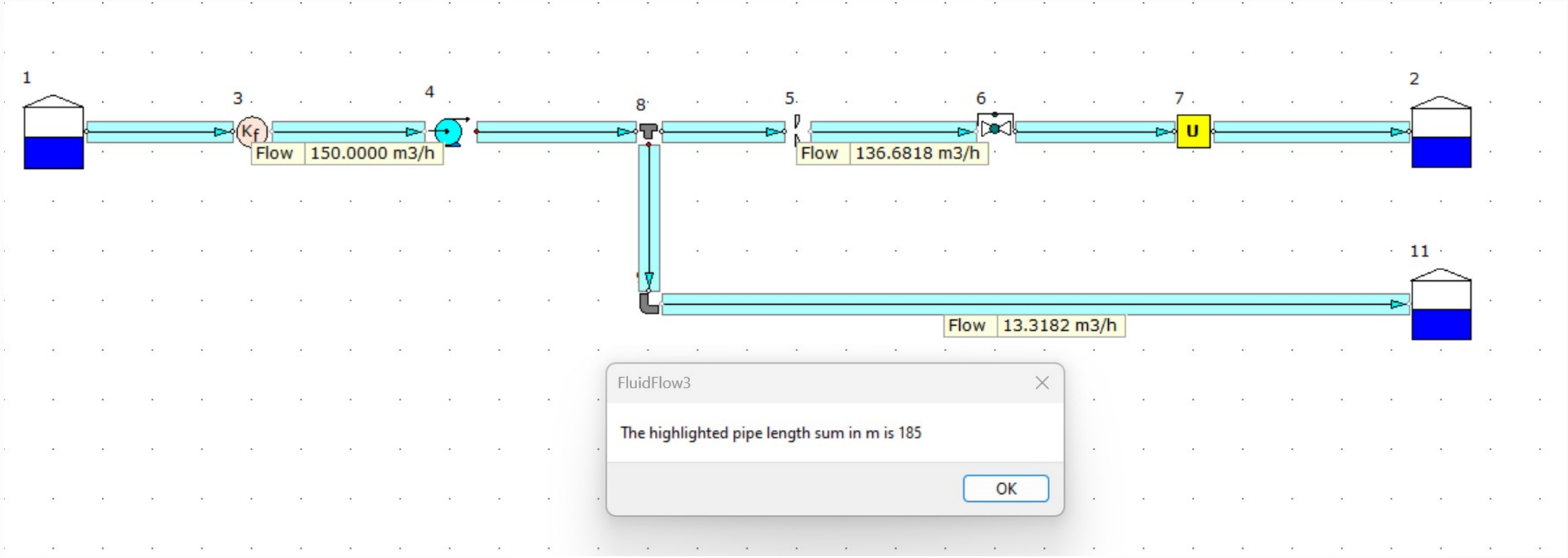
FluidFlow Special Features

- Scripts



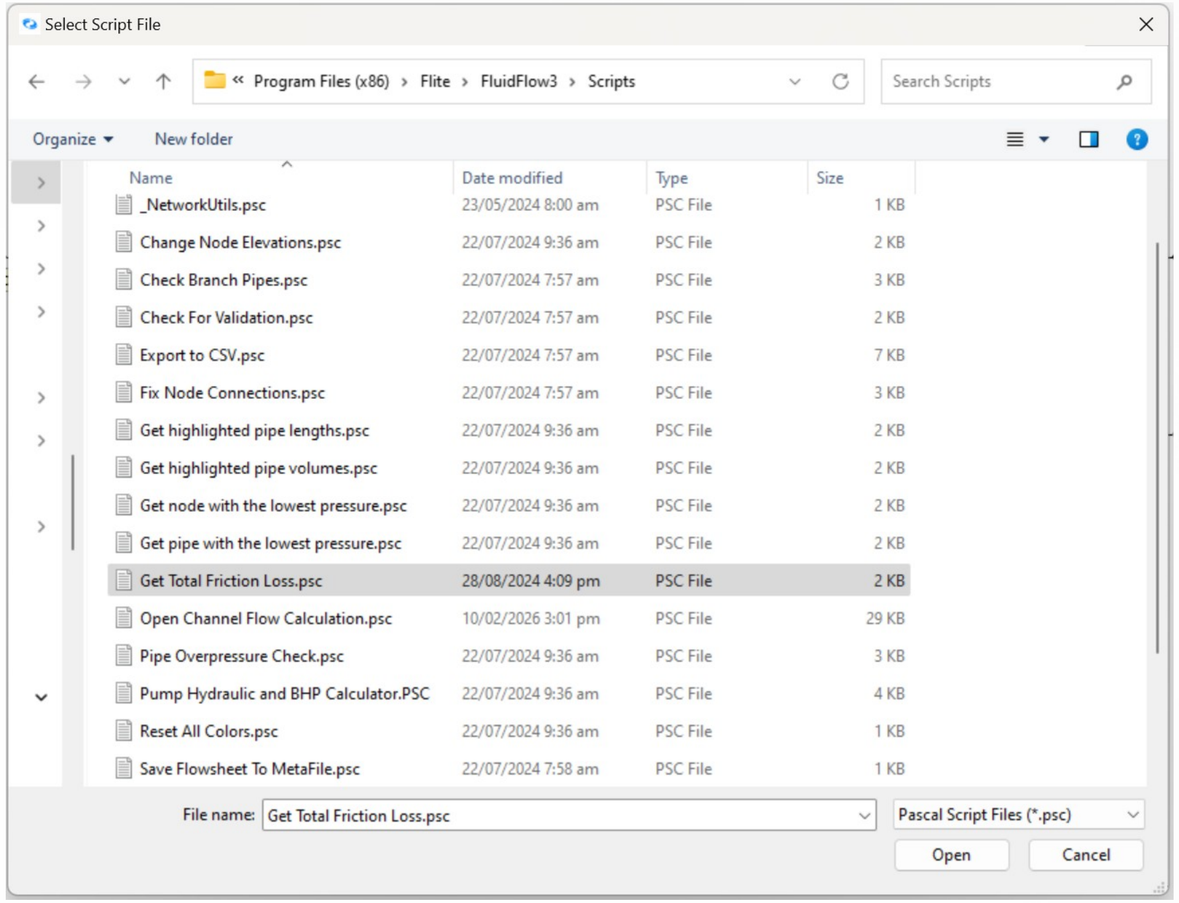
FluidFlow Special Features

❑ Scripts



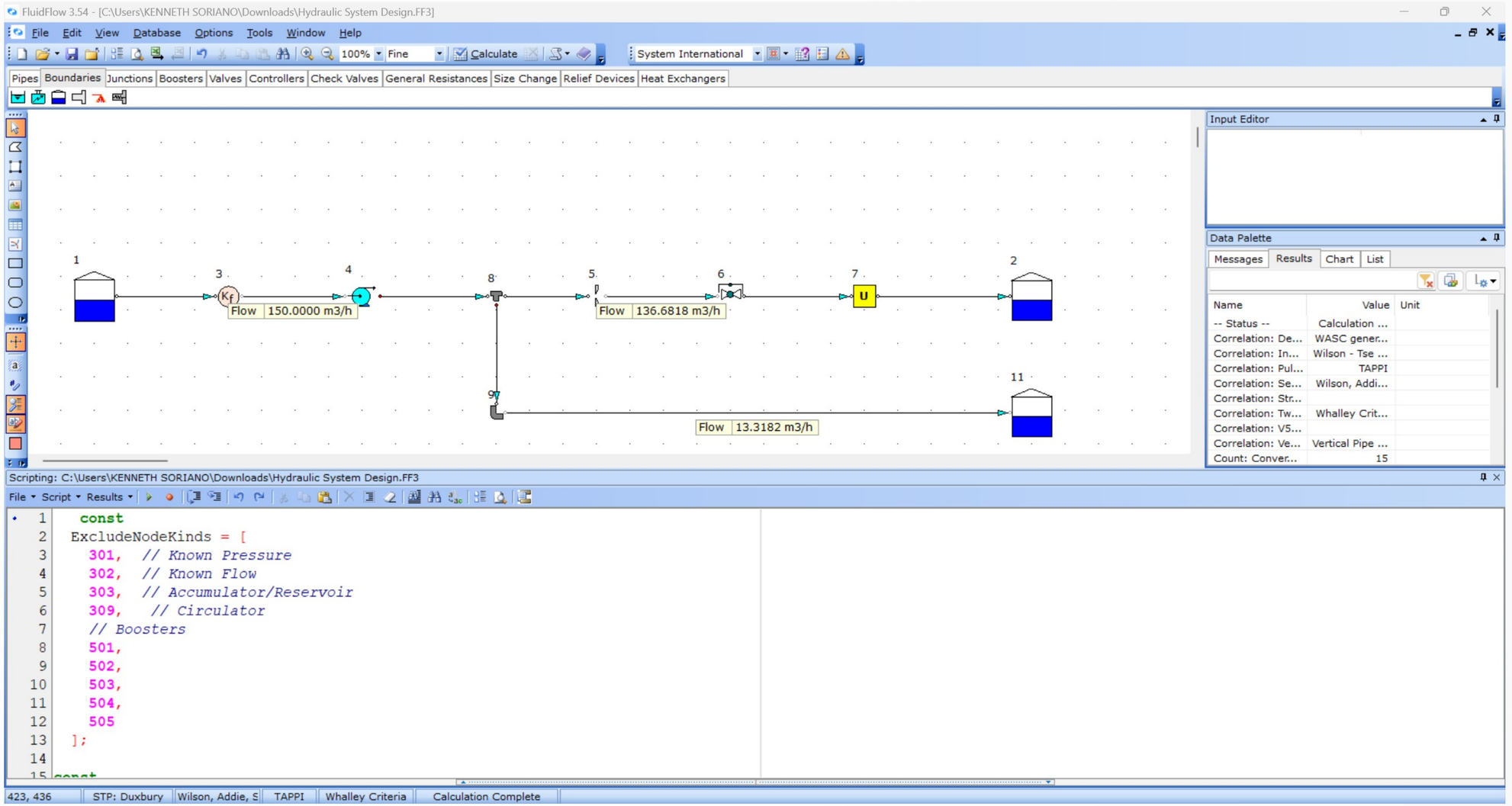
FluidFlow Special Features

❑ Scripts



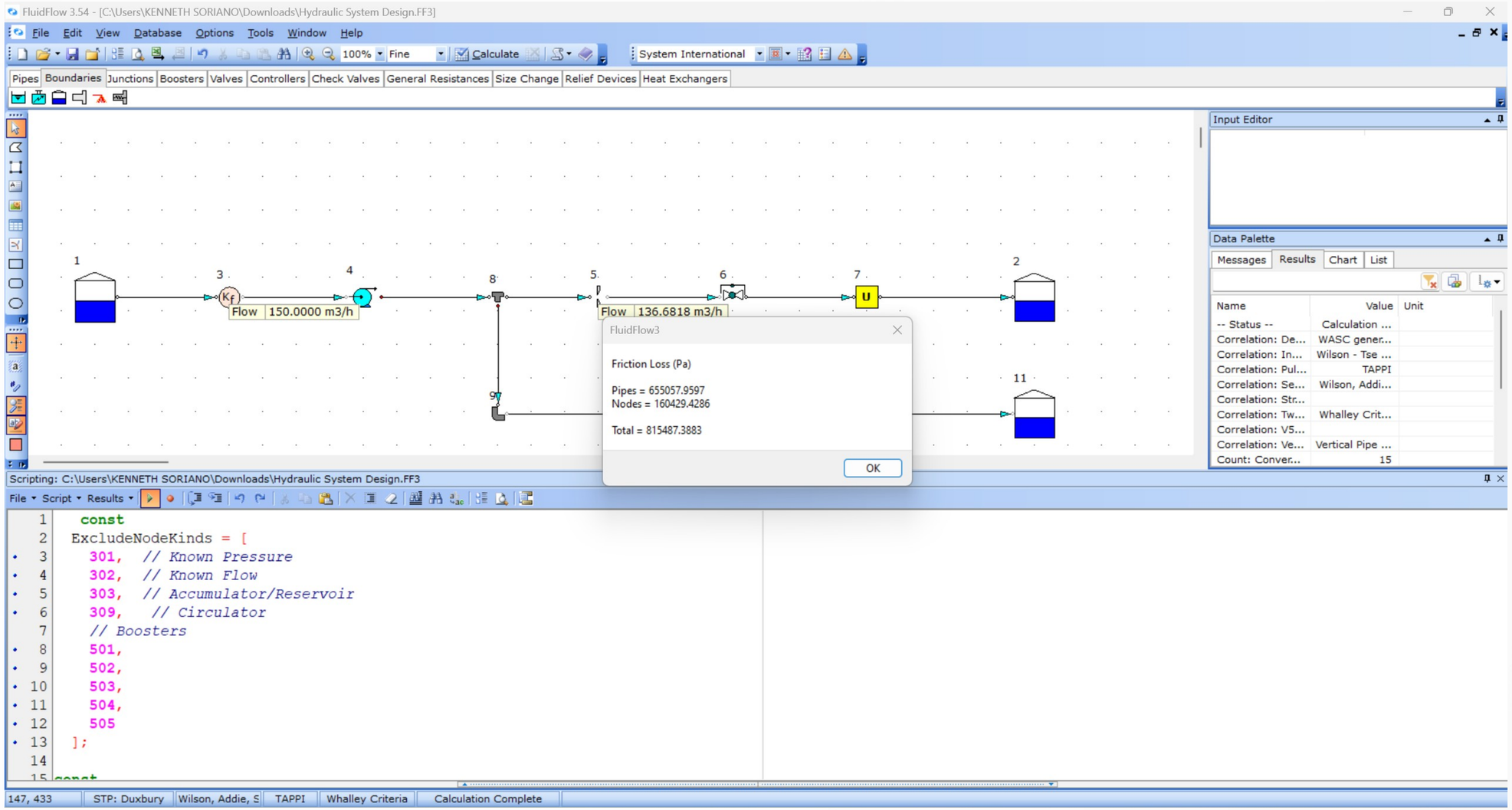
FluidFlow Special Features

- Scripts



FluidFlow Special Features

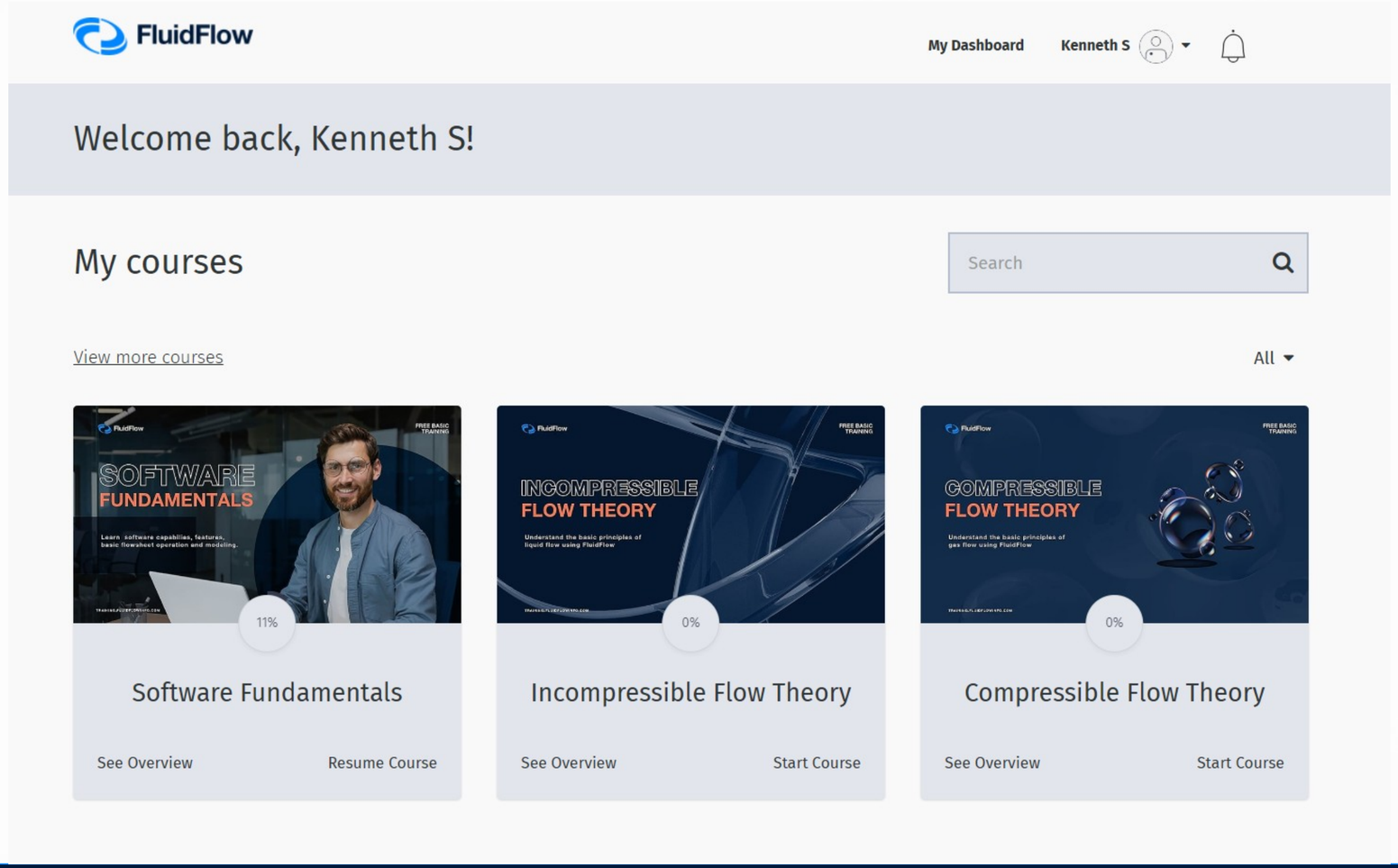
- Scripts



FLUIDFLOW
BASIC AND ADVANCED
TRAINING

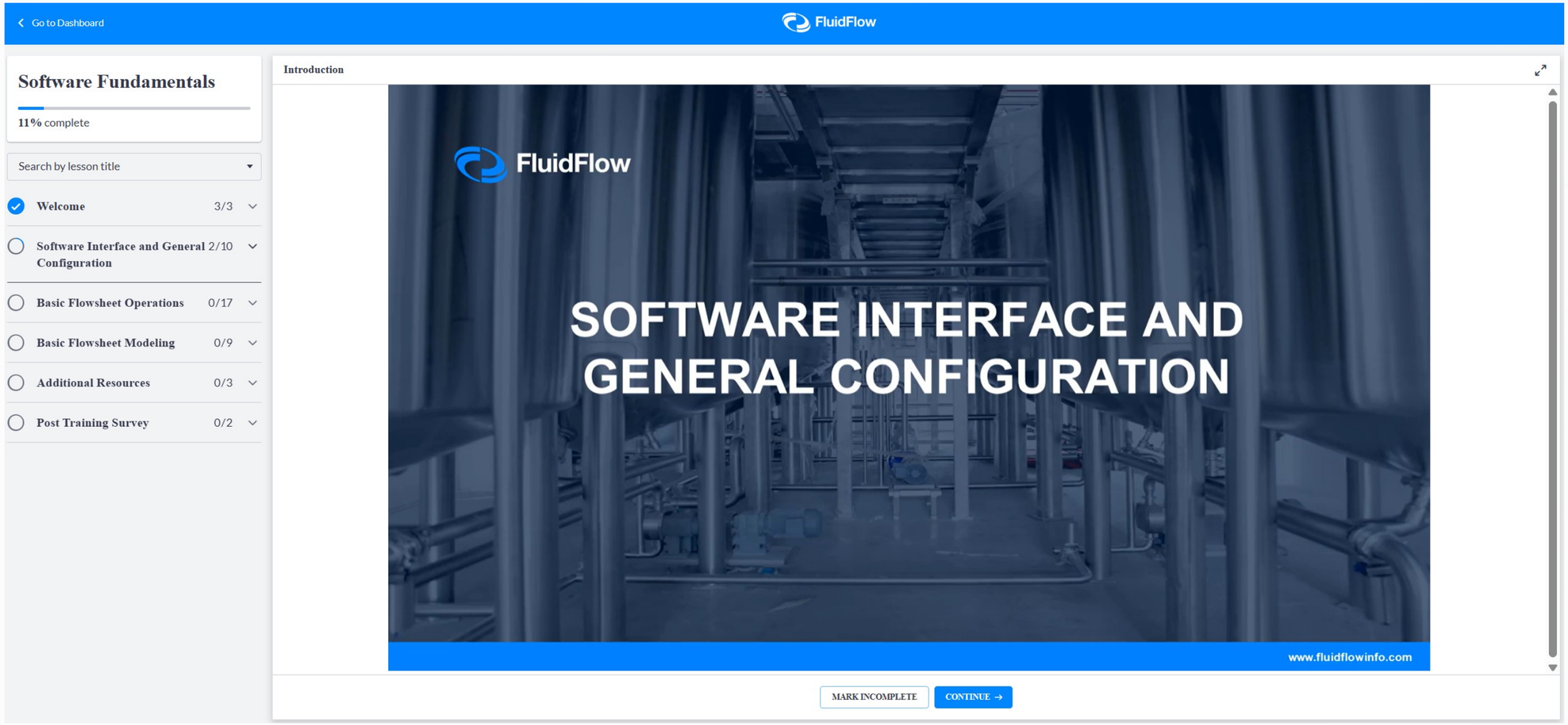
FluidFlow Basic and Advanced Training

❑ Basic Training (FREE)



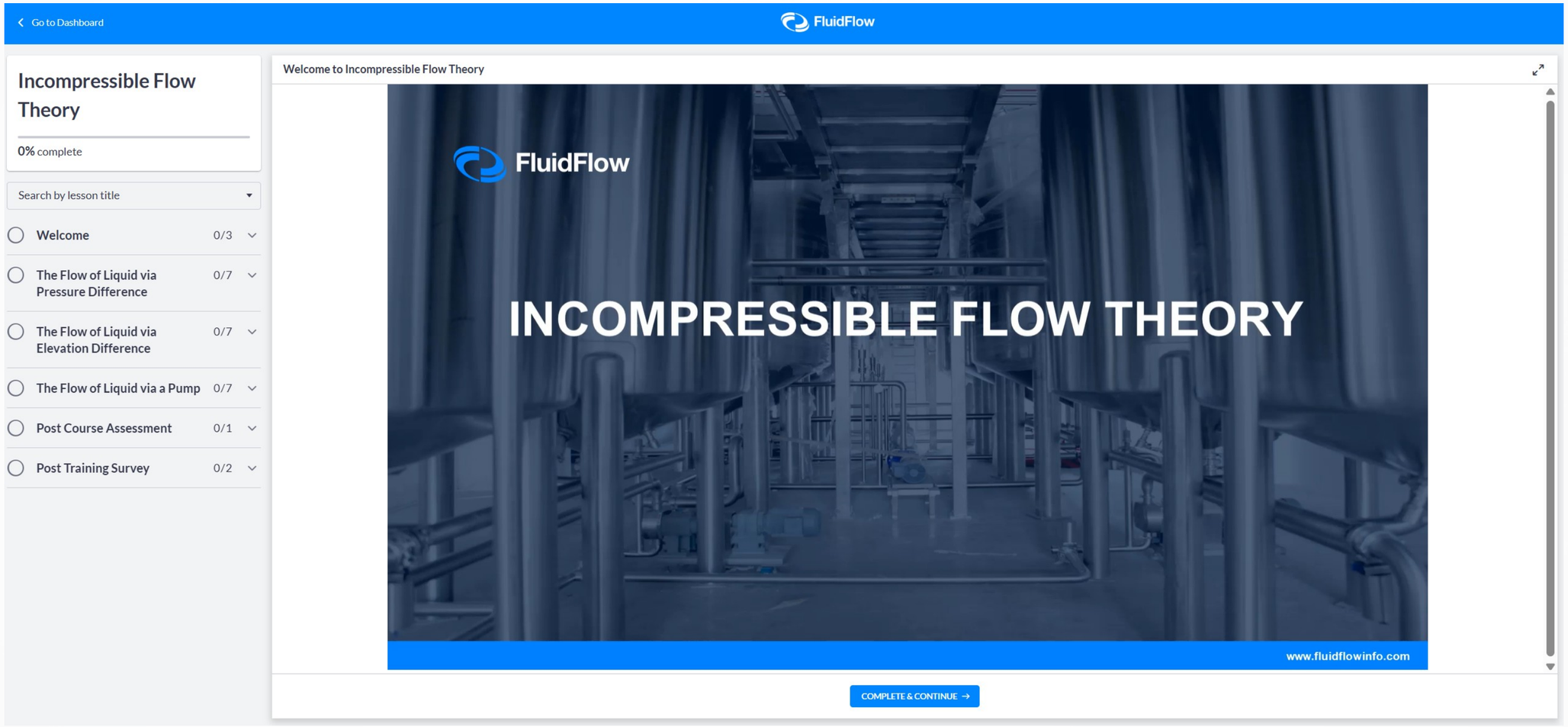
FluidFlow Basic and Advanced Training

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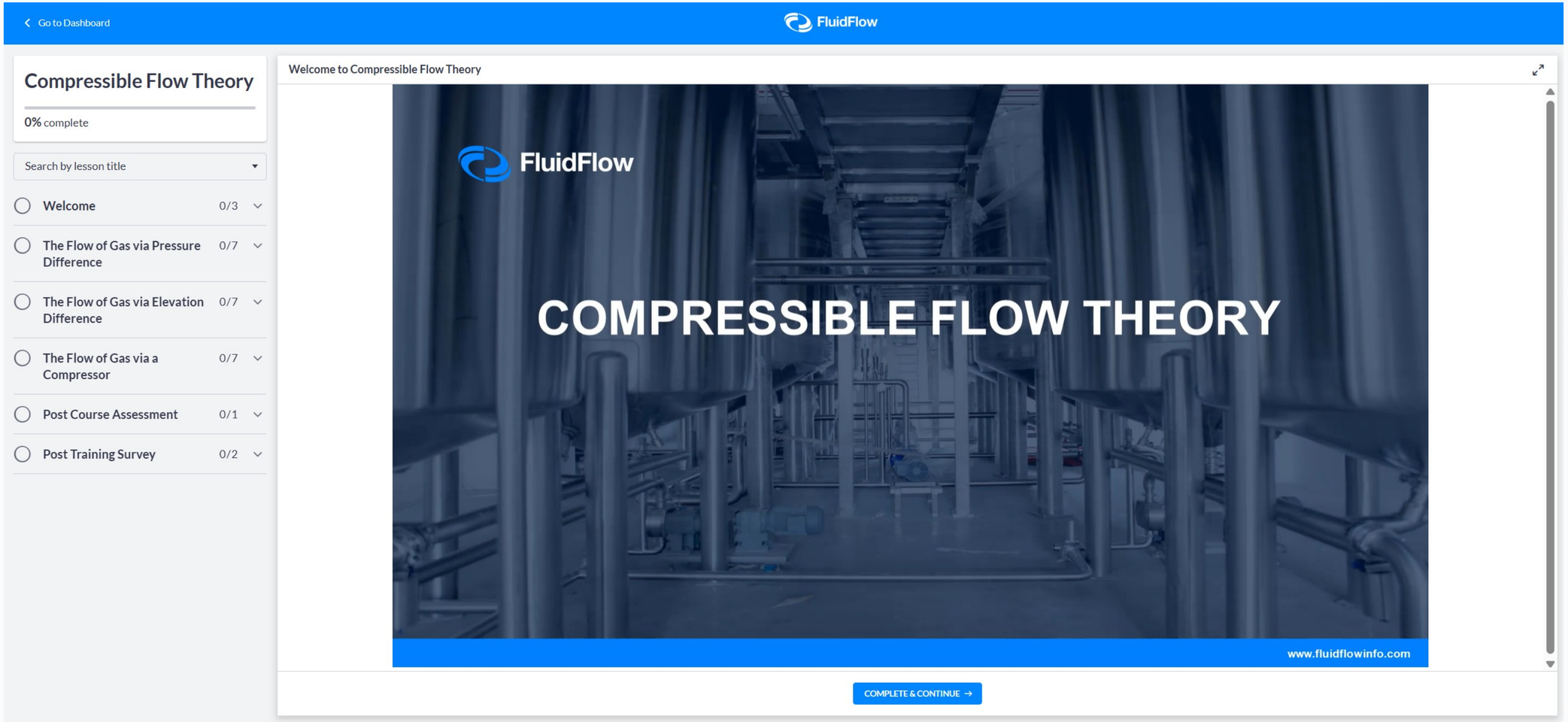
FluidFlow Basic and Advanced Training

❑ Basic Training (FREE)



FluidFlow Basic and Advanced Training

❑ Basic Training (FREE)



FluidFlow Basic and Advanced Training

❑ Advanced Training

Explore Our Comprehensive Course Modules

Detailed Course Content:

Fundamentals Module:

- Software Interface and General Configuration
- Basic Flowsheet Operations
- Fundamentals of Fluid Network Modeling
- Database Operations
- Hydraulic Calculation Procedure
- Results Analysis and Interpretation

Two-Phase Module

- Two-Phase Flow Theory
- Two-phase flow patterns and modeling approaches
- Flow regime mapping and visualization
- Pressure drop correlations for two-phase systems
- Line Sizing for Two-Phase Flow

FluidFlow Basic and Advanced Training

❑ Advanced Training

Liquid Module

- Introduction to Pumps
- Pump Sizing Principles
- Developing Pump Process Datasheets
- Centrifugal Pump Performance Modeling
- Centrifugal Pump Curve Viscosity Correction
- Centrifugal Pump Affinity Laws
- Liquid Service Control Valve Sizing
- Analyzing Pump Performance in FluidFlow

Gas Module

- Compressible Flow Principles and Calculations
- Pressure Drop in Gas Networks
- Gas Property Modeling and Equations of State
- Control Valve Basics, Sizing & Selection
- Line Sizing for Gas/Vapor
- Choked Flow Analysis
- Heat Transfer in Gas Systems
- Fan and Compressor Selection

Slurry Module

- Introduction to Slurries
- Slurry Pipe Characteristic Curve
- Settling Slurry Model Input Data
- Settling Slurry Friction Loss
- Slurry Flow Characteristic Velocities
- Specific Energy Consumption
- Non-Horizontal Settling Slurry Flows
- Centrifugal Slurry Pump Performance
- Introduction to Non-Newtonian Liquids
- Newtonian vs. Non-Newtonian Hydraulic Modeling
- Non-Newtonian Viscosity Models
- Defining Non-Newtonian Viscosity
- Non-Newtonian Friction Loss Calculations
- Non-Newtonian Centrifugal Pump Viscosity Correction

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(support@fluidflowinfo.com)

Customer Success
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