HydrauCalc

2024a Release

www.hydraucalc.com

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APPLICATION DESCRIPTION

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APPLICATION DESCRIPTION

HydrauCalc is a software application that allows accurate modeling and calculating of stabilized flows in piping elements as straight pipes, bends, changes of cross-section, tees, valves, orifices and more.

HydrauCalc is particularly suitable for pre-projects because it allows to estimate quickly the pressure losses of the components of a hydraulic installation, and thus to specify the characteristics of the pumps.

Friction Loss is calculated using the Darcy-Weisbach method, which provides accurate results for non-compressible fluids (liquids). This method also provides satisfactory results of reasonable accuracy for compressible fluids (gases) when the flow velocity is not very high.

HydrauCalc is mainly based on well-known and respected references in the field of fluid flow and pressure drop calculation.

THE REFERENCES

MAINLY REFERENCES

[1] Handbook of Hydraulic Resistance, I.E. Idelchik

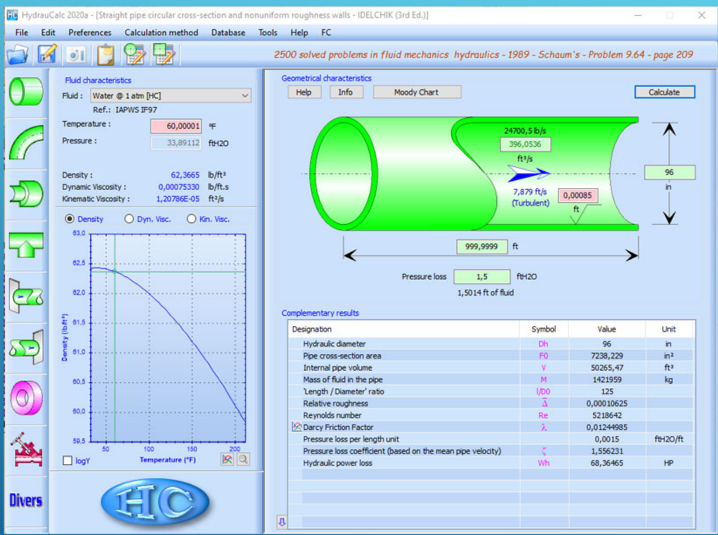
[2] Internal Flow System, D.S. Miller

[3] CRANE - Flow of Fluids Through Valves, Fitting and Pipe - Technical Paper No. 410

[4] Pipe Flow - A Practical and Comprehensive Guide, D. C. Rennels, H. M. Hudson

THE GRAPHICAL USER INTERFACE

GRAPHICAL USER INTERFACE

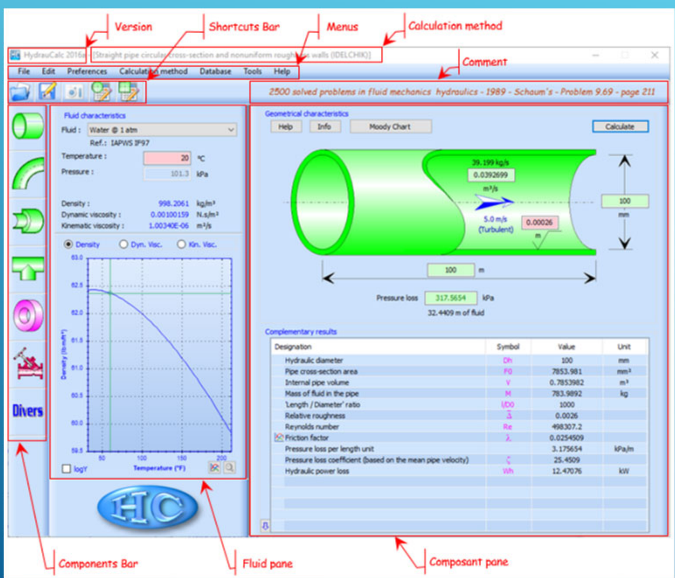


The graphical user interface is available in English, French or Spanish.

From this interface, the user selects the type of component he wants to calculate and the fluid carried in this component. It also provides the necessary input data (fluid and flow characteristics and component geometry).

This interface is intuitive and very easy-to-use.

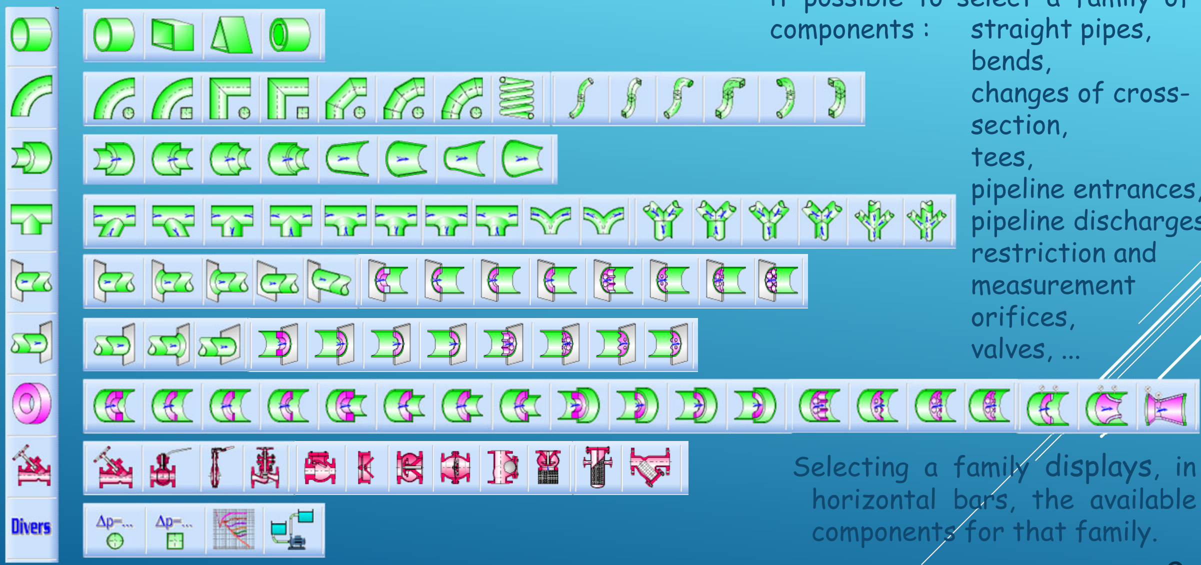
GRAPHICAL INTERFACE STRUCTURE



The graphical interface is structured in four main parts:

- The components bar
- The fluid pane
- The component pane
- The upper part which includes:
  - The information about release and calculation method chosen
  - Menus and shortcuts bar
  - The display area for a possible comment

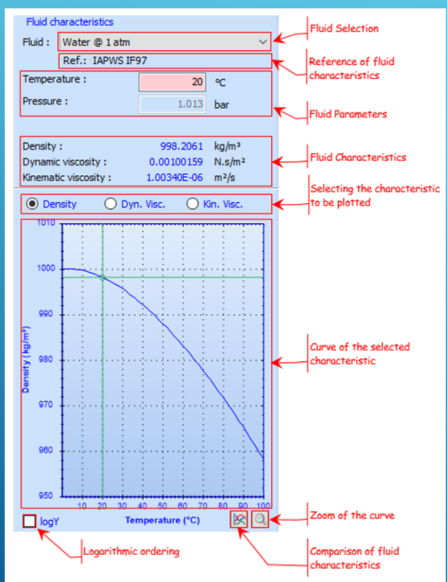
COMPONENTS BARS



The vertical components bar makes it possible to select a family of components : straight pipes, bends, changes of cross-section, tees, pipeline entrances, pipeline discharges, restriction and measurement orifices, valves, …

Selecting a family displays, in horizontal bars, the available components for that family.

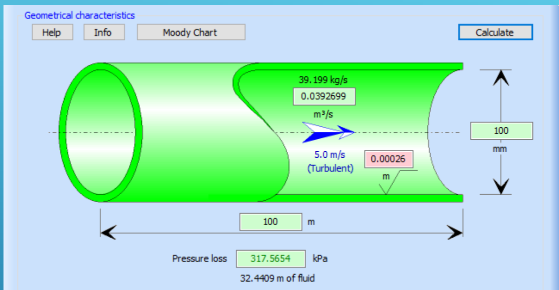
FLUID PANE



The fluid pane mainly allows:

- Select the fluid
- Set the fluid according to the selected fluid type (temperature, pressure, salinity, quality, humidity, …)
- Visualize the characteristics of the fluid (density, dynamic and kinematic viscosity)
- Visualize the evolution of the characteristics according to the temperature or the pressure (according to the type of selected fluid)

COMPONENT PANE



Complementary results

Designation	Symbol	Value	Unit
Hydraulic diameter	Dh	100	mm
Pipe cross-section area	F0	7853.981	mm²
Internal pipe volume	V	0.7853982	m³
Mass of fluid in the pipe	M	783.9892	kg
'Length / Diameter' ratio	l/D0	1000	
Relative roughness	Δ̄	0.0026	
Reynolds number	Re	498307.2	
Friction factor	λ	0.0254509	
Pressure loss per length unit		3.175654	kPa/m
Pressure loss coefficient (based on the mean pipe velocity)	ζ	25.4509	
Hydraulic power loss	Wh	12.47076	kW

The component pane allows you to:

- Define the geometry of the component according to the selected component type (inside diameter, length, roughness, ...)
- Define flow (volume flowrate)
- Execute the calculation of the component
- Visualize the results
- Display the Moody diagram corresponding to the calculation with the calculated point (case of friction loss)
- Access information about the component:
  - Help (technical documentation of the component)
  - Info (information on the use of the component)
  - Other eventually

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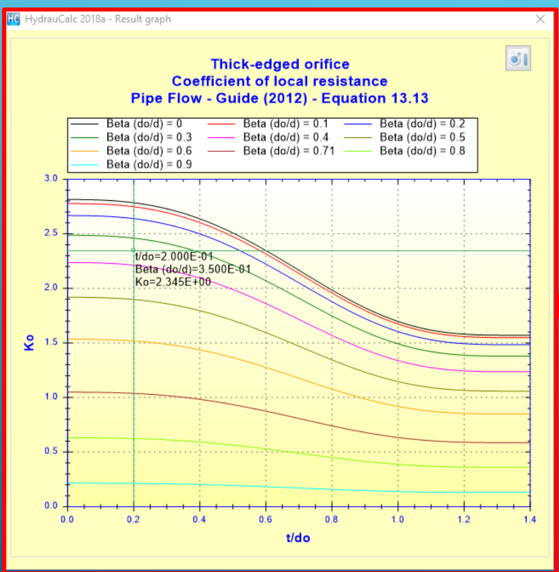
COMPLEMENTARY RESULTS



When, in the complementary results, the variable is preceded by the symbol, a simple click on this variable shows the evolution graph of the variable with the calculated point.

Example :

Designation	Symbol	Value	Unit
Pipe cross-section area	A	7853.981	mm²
Orifice cross-section area	Ao	962.1127	mm²
Diameters ratio (Do/d)	β	0.35	
Cross-sections area ratio	Ao/A	0.1225	
Thickness to orifice diameter ratio	t/Do	0.2	
Pipe Reynolds number	NRe	498307.2	
Orifice Reynolds number	NReo	1423735	
Velocity in vena contracta	Vc	65.43075	m/s
Jet velocity ratio (Equation 13.4)	λ	1.603054	
Coefficient Cth (Equation 13.14)	Cth	0.9763061	
Coefficient of local resistance (Equation 13.13)	Ko	2.34488	
Pressure loss coefficient (based on the mean pipe velocity)	K	156.2602	
Hydraulic power loss	Wh	76.56641	kW

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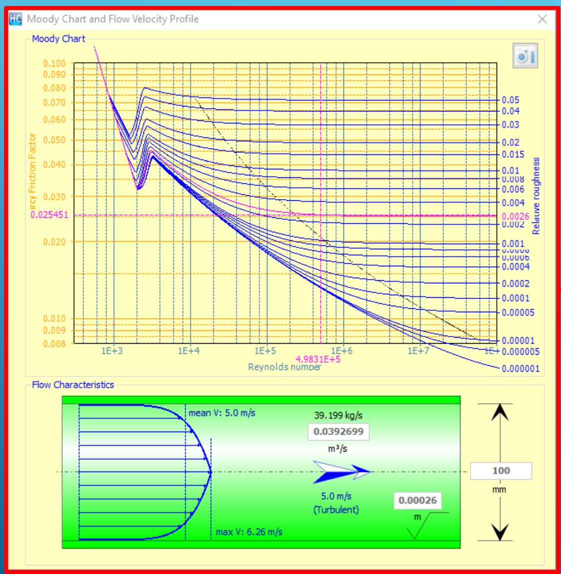
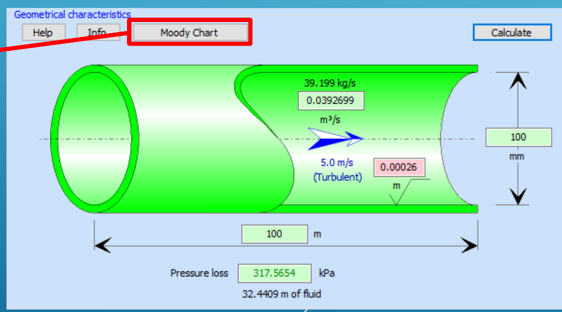
MOODY DIAGRAM



When the component is subjected to friction, the Moody diagram can be consulted to observe the operating point (as well as the flow velocity profile).

Example of a straight pipe:



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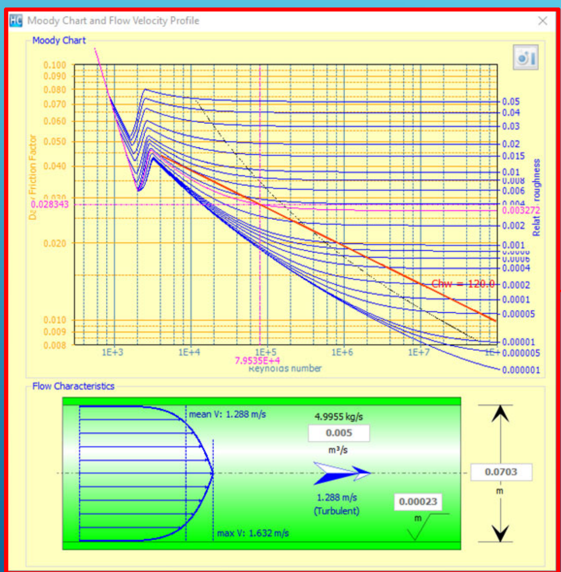
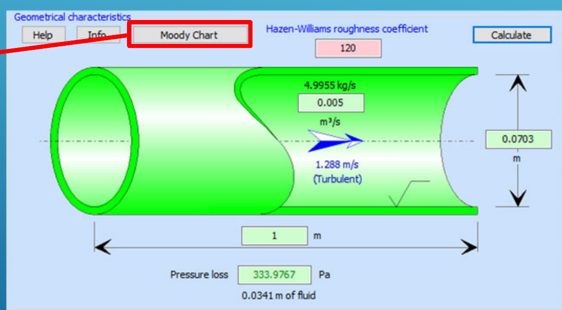
MOODY DIAGRAM AND HAZEN-WILLIAMS FORMULA



For the "Hazen-Williams" calculation method for circular cross-section straight pipes, the Moody diagram shows the relationship between the roughness coefficient of the Hazen-Williams formula and the friction coefficient of Darcy. The diagram also shows the limits of applicability of the Hazen-Williams formula.



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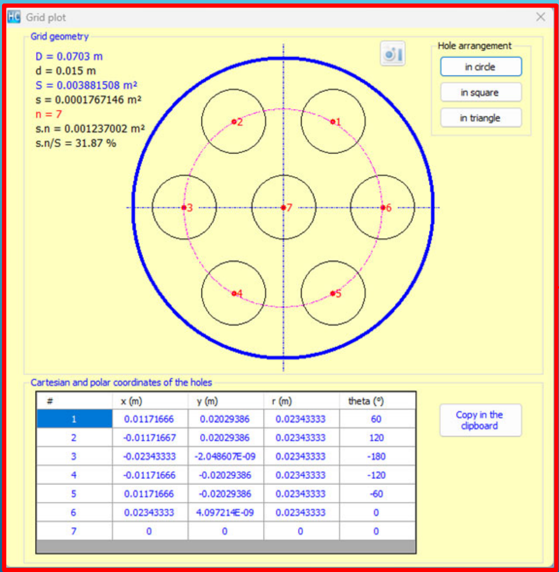
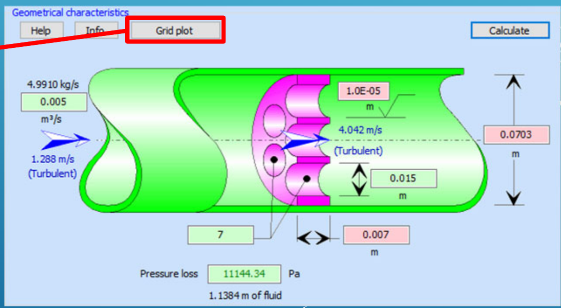
GRID PLOT



For "Grid" components (perforated plate), the application provides a grid plot with the coordinates of each hole.

Example of a perforated plate plot:



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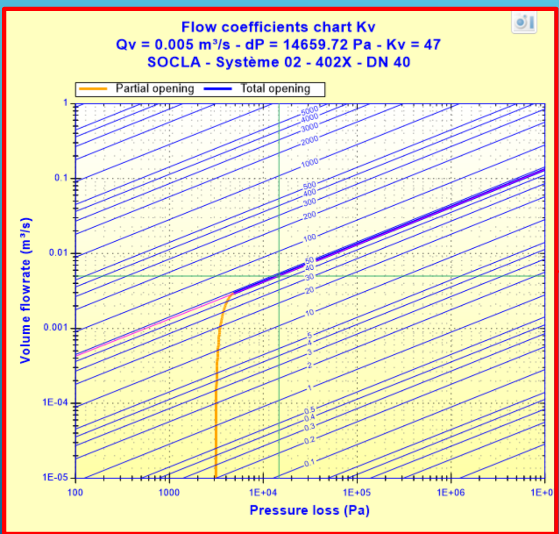
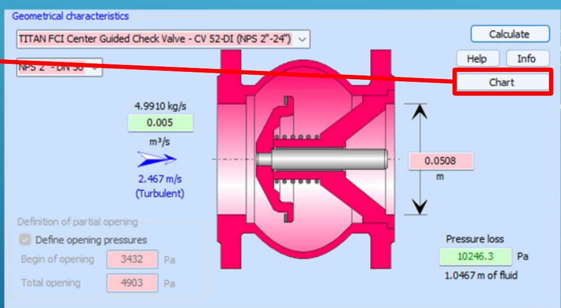
FLOW COEFFICIENT CHART



For "Valve and Check valve" components, the application provides a diagram with plot of the working point.

Example of check valve:



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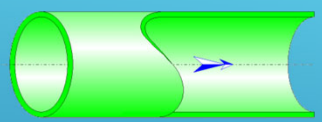
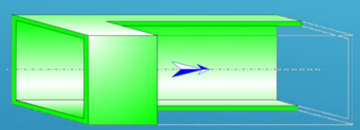
THE COMPONENTS

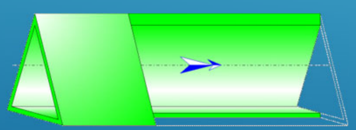
STRAIGHT PIPES



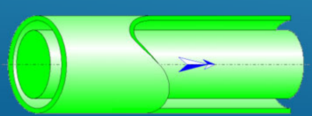
Circular cross-section



Rectangular cross-section



Triangular cross-section



Annular cross-section

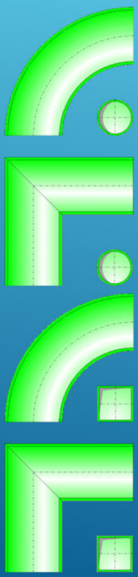
The proposed calculation methods:

- IDELCHIK
  - Uniform roughness walls (Nikuradze equation)
  - Nonuniform roughness walls (Colebrook-White equation)
  - Smooth roughness walls (Filonenko and Althsul equation)
  - Explicit Darcy friction factor
- MILLER
  - Roughness walls (Swamee-Jain equation)
  - Explicit Darcy friction factor
- HAZEN-WILLIAMS (only circular cross-section)
  - Roughness walls (Hazen-Williams equation)

The proposed calculations:

- Pressure loss
- Volume flowrate
- Length of pipe
- Inside diameter (circular cross-section)
- Height or width (rectangular cross-section)
- Height or base (triangular cross-section)

BENDS (1)



Smooth bend with circular cross-section

Miter bend with circular cross-section

Smooth bend with rectangular cross-section

Miter bend with rectangular cross-section

The proposed calculation methods:

- IDELCHIK
- MILLER
- CRANE
- Pipe Flow Guide

The proposed calculations:

- Pressure loss
- Volume flowrate

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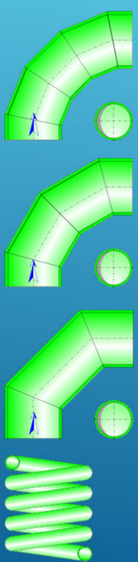
BENDS (2)



Composite bend 90° with circular cross-section (4 x 22.5°)

Composite bend 90° with circular cross-section (3 x 30°)

Composite bend 90° with circular cross-section (2 x 45°)

Helical tube

The proposed calculation methods:

- IDELCHIK
- MILLER
- CRANE
- Pipe Flow Guide

The proposed calculations:

- Pressure loss
- Volume flowrate

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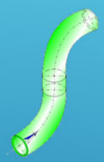
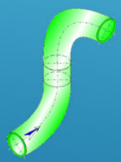
BENDS (3)



S-shaped bends with circular cross-section (flow in one plane)



S-shaped bends with circular cross-section (flow in two perpendicular planes)

U-shaped bends with circular cross-section (flow in one plane)

The proposed calculation methods:

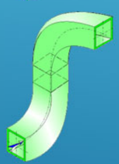
- IDELCHIK
- MILLER

The proposed calculations:

- Pressure loss
- Volume flowrate

BENDS (4)

S-shaped bends with rectangular cross-section (flow in one plane)



S-shaped bends with rectangular cross-section (flow in two perpendicular planes)

U-shaped bends with rectangular cross-section (flow in one plane)

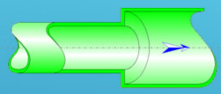
The proposed calculation methods:

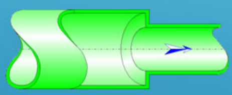
- IDELCHIK
- MILLER

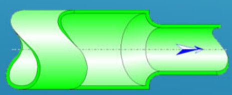
The proposed calculations:

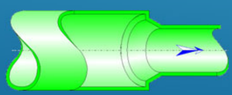
- Pressure loss
- Volume flowrate

CHANGES OF CROSS-SECTION (1)


Sudden expansion


Sudden contraction sharp


Sudden contraction rounded


Sudden contraction bevelled

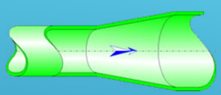
The proposed calculation methods:

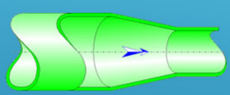
- IDELCHIK
- MILLER
- CRANE
- Pipe Flow Guide

The proposed calculations:

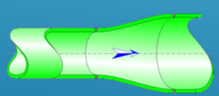
- Pressure loss
- Volume flowrate

CHANGES OF CROSS-SECTION (2)

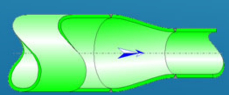

Gradual expansion


Gradual contraction

New R2024a


Welded pipe expansion
(ANSI standard pipe reducer)

New R2024a


Welded pipe contraction
(ANSI standard pipe reducer)

The proposed calculation methods:

- IDELCHIK
- MILLER
- CRANE
- Pipe Flow Guide

Nota : Only the "Pipe Flow Guide" method is proposed for the ANSI standard pipe reducers

The proposed calculations:

- Pressure loss
- Volume flowrate

ENTRANCE OF PIPELINE (1)

Flush-mounted sharp-edged entrance

Flush-mounted rounded entrance

Flush-mounted bevelled entrance

Sharp-edged entrance mounted at a distance

Sharp-edged entrance mounted at an angle

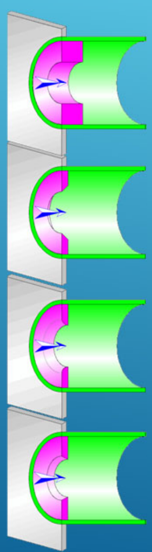
The proposed calculation methods:

- IDELCHIK
- MILLER
- CRANE
- Pipe Flow Guide

The proposed calculations:

- Pressure loss
- Volume flowrate

ENTRANCE OF PIPELINE (2)



Entrance through a thick-edged orifice

Entrance through a sharp-edged orifice

Entrance through a round-edged orifice

Entrance through a bevel-edged orifice

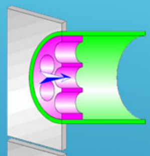
The proposed calculation method:

- IDELCHIK
- Pipe Flow Guide New R2024a

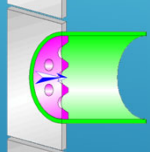
The proposed calculations:

- Pressure loss
- Volume flowrate
- Orifice diameter

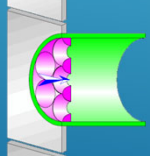
ENTRANCE OF PIPELINE (3)



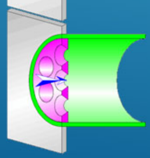
Entrance through a thick-edged grid



Entrance through a sharp-edged grid



Entrance through a round-edged grid



Entrance through a bevel-edged grid

The proposed calculation method:

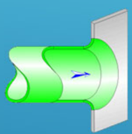
- ❑ IDELCHIK

The proposed calculations:

- ❑ Pressure loss
- ❑ Volume flowrate
- ❑ Holes diameter
- ❑ Holes number

DISCHARGE OF PIPELINE (1)

Flush-mounted sharp-edged discharge



Flush-mounted rounded discharge

Sharp-edged discharge mounted at a distance

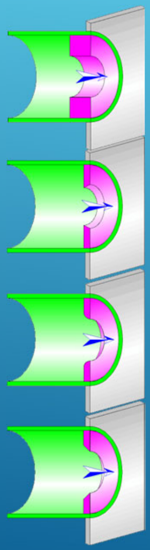
The proposed calculation methods:

- ❑ IDELCHIK
- ❑ MILLER
- ❑ CRANE
- ❑ Pipe Flow Guide

The proposed calculations:

- ❑ Pressure loss
- ❑ Volume flowrate

DISCHARGE OF PIPELINE (2)



Discharge from a thick-edged orifice

Discharge from a sharp-edged orifice

Discharge from a round-edged orifice

Discharge from a bevel-edged orifice

The proposed calculation method:

- IDELCHIK
- Pipe Flow Guide New R2024a

The proposed calculations:

- Pressure loss
- Volume flowrate
- Orifice diameter

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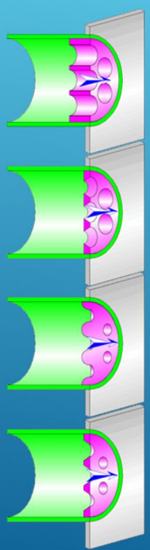
DISCHARGE OF PIPELINE (3)



Discharge from a thick-edged grid

Discharge from a sharp-edged grid

Discharge from a round-edged grid

Discharge from a bevel-edged grid

The proposed calculation method:

- IDELCHIK

The proposed calculations:

- Pressure loss
- Volume flowrate
- Holes diameter
- Holes number

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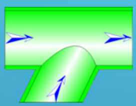
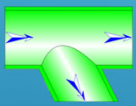
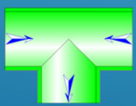
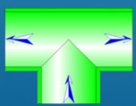
JUNCTIONS (1)


Combining sharp-edged junction


Dividing sharp-edged junction


Symmetric combining sharp-edged T-junction


Symmetric dividing sharp-edged T-junction

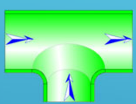
The proposed calculation methods:

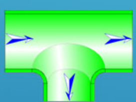
- IDELCHIK
- MILLER
- CRANE

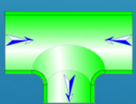
The proposed calculation:

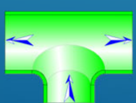
- Pressure loss in each branch

JUNCTIONS (2)


Combining radiused-edged T-junction


Dividing radiused-edged T-junction


Symmetric combining radiused-edged T-junction


Symmetric dividing radiused-edged T-junction

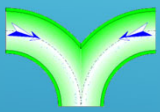
The proposed calculation methods:

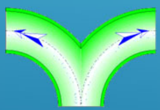
- MILLER
- Pipe Flow Guide

The proposed calculation:

- Pressure loss in each branch

JUNCTIONS (3)


Symmetric combining T-junction with smooth turn through 90°


Symmetric dividing T-junction with smooth turn through 90°

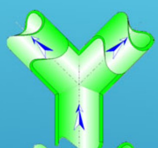
The proposed calculation method:

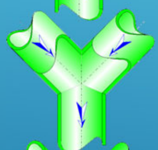
- IDELCHIK

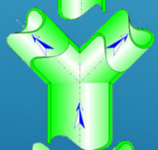
The proposed calculation:

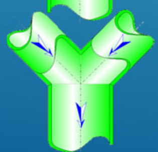
  - Pressure loss in each branch

Y-JUNCTIONS (4)


Symmetrical dividing Y-junction with branches of equal sections


Symmetrical combining Y-junction with branches of equal sections


Symmetrical dividing Y-junction with branches of unequal sections


Symmetrical combining Y-junction with branches of unequal sections

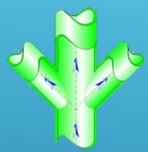
The proposed calculation methods:

- IDELCHIK
- MILLER

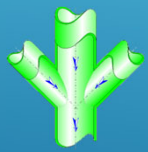
The proposed calculation:

  - Pressure loss in each branch

JUNTIONS (5)



Four-way dividing junction
with branches of unequal sections



Four-way combining junction
with branches of unequal sections

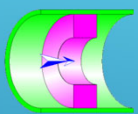
The proposed calculation method:

- IDELCHIK

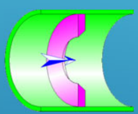
The proposed calculation:

- Pressure loss in each branch

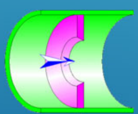
RESTRICTION ORIFICES (1)



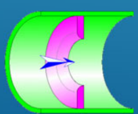
Thick-edged orifice



Sharp-edged orifice



Bevel-edged orifice



Round-edged orifice

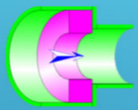
The proposed calculation methods:

- IDELCHIK
- MILLER
- CRANE
- Pipe Flow Guide

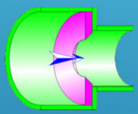
The proposed calculations:

- Pressure loss
- Volume flowrate
- Orifice diameter

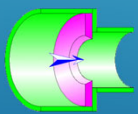
RESTRICTION ORIFICES (2)



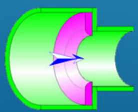
Thick-edged orifice
(with pipe contraction)



Sharp-edged orifice
(with pipe contraction)



Bevel-edged orifice
(with pipe contraction)



Round-edged orifice
(with pipe contraction)

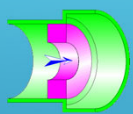
The proposed calculation methods:

- IDELCHIK
- Pipe Flow Guide

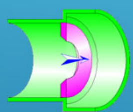
The proposed calculations:

- Pressure loss
- Volume flowrate
- Orifice diameter

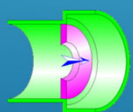
RESTRICTION ORIFICES (3)



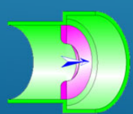
Thick-edged orifice
(with pipe expansion)



Sharp-edged orifice
(with pipe expansion)



Bevel-edged orifice
(with pipe expansion)



Round-edged orifice
(with pipe expansion)

New R2024a

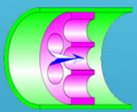
The proposed calculation methods:

- IDELCHIK
- Pipe Flow Guide

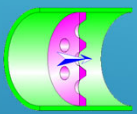
The proposed calculations:

- Pressure loss
- Volume flowrate
- Orifice diameter

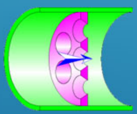
GRIDS



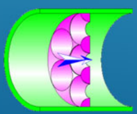
Thick-edged grid



Sharp-edged grid



Bevel-edged grid



Round-edged grid

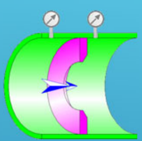
The proposed calculation methods:

- IDELCHIK
- MILLER
- Pipe Flow Guide

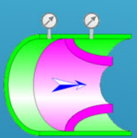
The proposed calculations:

- Pressure loss
- Volume flowrate
- Holes diameter
- Holes number

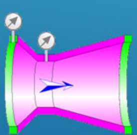
MEASUREMENT ORIFICES



Orifice plate flowmeter



Nozzle and Venturi nozzle flowmeter



Venturi tube flowmeter

The proposed calculation methods:

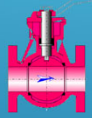
- ISO 5167:2003
- ISO 5167:1991
- CRANE 1999

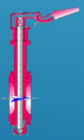
The proposed calculations:

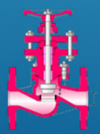
- Measured differential pressure
- Net pressure loss
- Volume flowrate
- Orifice diameter

VALVES


Y globe valve


Ball valve


Butterfly valve


Globe valve

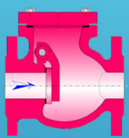
The proposed calculation methods:

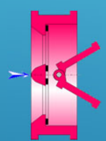
- IDELCHIK
- MILLER
- Manufacturers

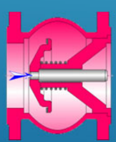
The proposed calculations:

- Pressure loss
- Volume flowrate

CHECK VALVES (1)


Swing check valve


Dual plate check valve


Axial check valve

The proposed calculation method:

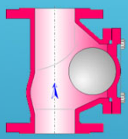
- Manufacturers

The proposed calculations:

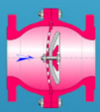
- Pressure loss
- Volume flowrate

CHECK VALVES (2)

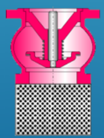
New R2024a



Ball check valve



Membrane check valve



Foot check valve

The proposed calculation method:

- Manufacturers

The proposed calculations:

  - Pressure loss
  - Volume flowrate

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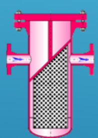
STRAINERS

New R2024a

Y strainer



Basket strainer

The proposed calculation method:

- Manufacturers

The proposed calculations:

  - Pressure loss
  - Volume flowrate

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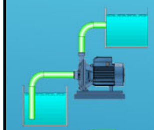
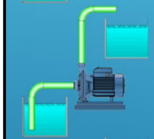
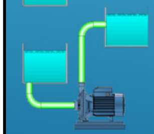
PUMP QUICK DESIGN



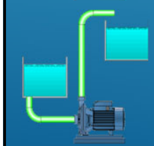
Suction lift operation
Tank with pipe ending below the fluid level



Suction lift operation
Free flow from the pipe ending above the water level



Suction head operation
Tank with pipe ending below the fluid level



Suction head operation
Free flow from the pipe ending above the water level

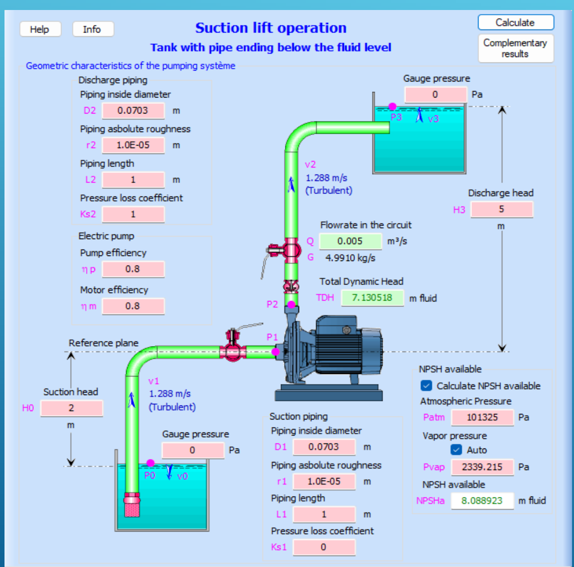
The proposed calculation method:

- KSB Manufacturer

The proposed calculations:

- Total Dynamic Head (TDH)
- Net Positive Suction Head available ($NPSH_a$)
- Pressure loss in suction and discharge lines
- Pressures at the pump flanges

PUMP QUICK DESIGN - EXAMPLE



Example of sizing a pump in suction operating mode and with pipe outlet below the fluid level in the tank.

THE MEASURE UNITS

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14/11/2024

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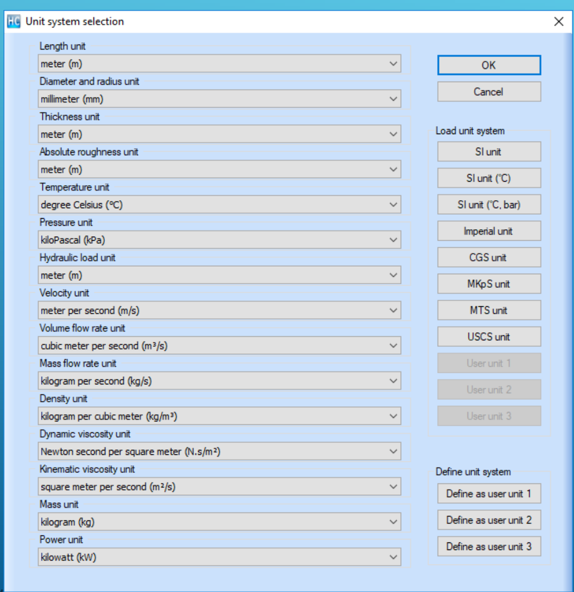
UNIT SYSTEM SELECTION



Units can be selected:

- individually
- by unit systems

The user can define his own systems of units (within the limit of three systems)

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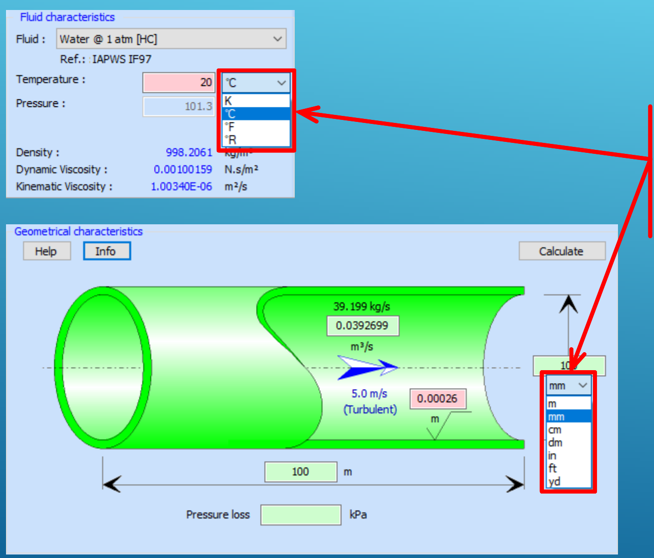
UNITS MODIFICATION



The application has a dynamic unit conversion engine.

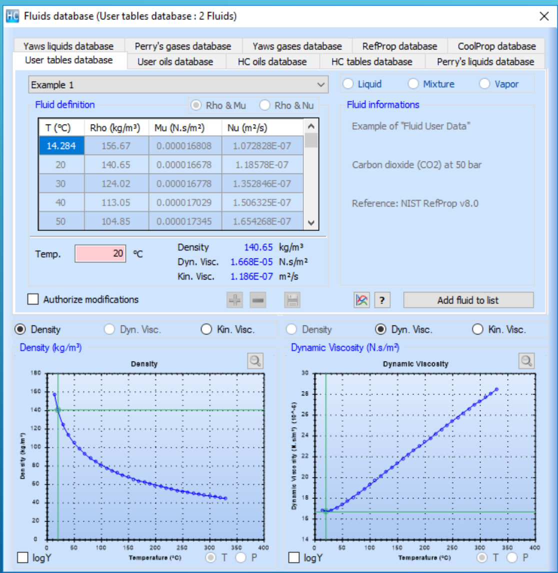
The units displayed in the Fluid Pane and Component Data Panes can be changed by simply clicking on the unit displayed.

After selecting a new unit, the value entered in the input box is automatically converted to the new unit.

The results will be displayed in the current units.

THE DATABASES

DATABASE - FLUIDS

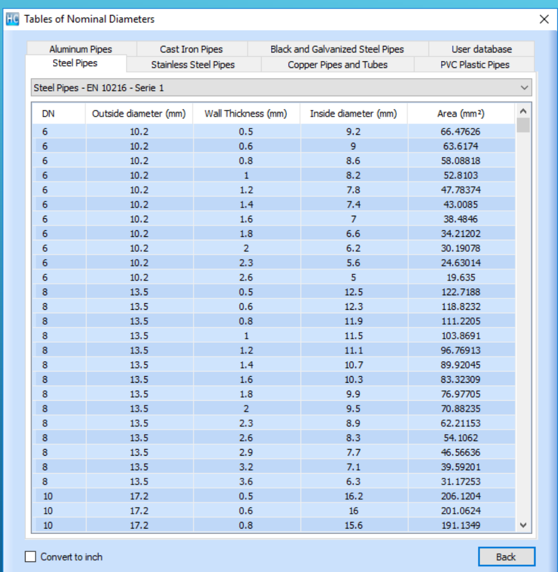


HydrauCalc has a fluid characteristics database consisting of several hundred fluids based on recognized references:

- Perry's Handbook
- Oil products
- Yaws Handbook
- Coolprop
- Refprop

The user can also define his own fluids in the form of point tables as a function of temperature.

DATABASE - PIPINGS



Tables of Nominal Diameters

Aluminum Pipes | Cast Iron Pipes | Black and Galvanized Steel Pipes | User database | Steel Pipes | Stainless Steel Pipes | Copper Pipes and Tubes | PVC Plastic Pipes

Steel Pipes - EN 10216 - Serie 1

DN	Outside diameter (mm)	Wall Thickness (mm)	Inside diameter (mm)	Area (mm²)
6	10.2	0.5	9.2	66.47626
6	10.2	0.6	9	63.6174
6	10.2	0.8	8.6	58.08818
6	10.2	1	8.2	52.8103
6	10.2	1.2	7.8	47.78374
6	10.2	1.4	7.4	43.0085
6	10.2	1.6	7	38.4846
6	10.2	1.8	6.6	34.21202
6	10.2	2	6.2	30.19078
6	10.2	2.3	5.6	24.63014
6	10.2	2.6	5	19.635
8	13.5	0.5	12.5	122.7188
8	13.5	0.6	12.3	118.8232
8	13.5	0.8	11.9	111.2205
8	13.5	1	11.5	103.8691
8	13.5	1.2	11.1	96.76913
8	13.5	1.4	10.7	89.92045
8	13.5	1.6	10.3	83.32309
8	13.5	1.8	9.9	76.97705
8	13.5	2	9.5	70.88235
8	13.5	2.3	8.9	62.21153
8	13.5	2.6	8.3	54.1062
8	13.5	2.9	7.7	46.56636
8	13.5	3.2	7.1	39.59201
8	13.5	3.6	6.3	31.17253
10	17.2	0.5	16.2	206.1204
10	17.2	0.6	16	201.0624
10	17.2	0.8	15.6	191.1349

Convert to inch

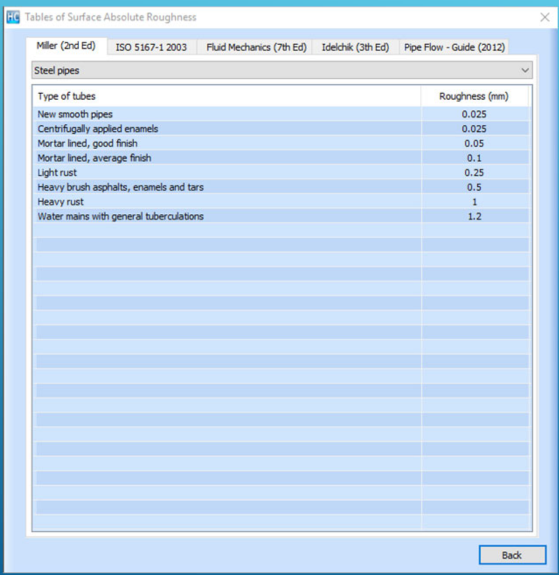
Back

HydrauCalc has a database defining the diameters of the main pipe standards.

- Steel piping
- Stainless steel piping
- Copper piping
- PVC piping
- Aluminium piping
- Cast iron piping
- Black and galvanized steel piping

The user can also add his own diameter tables.

DATABASE - WALL ROUGHNESS'S

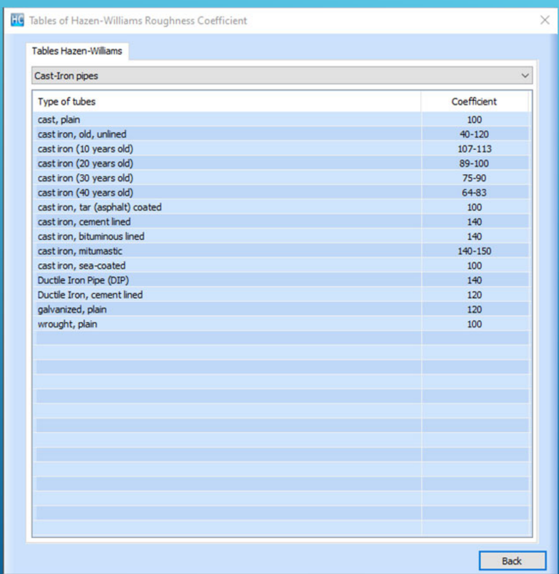


Type of tubes	Roughness (mm)
New smooth pipes	0.025
Centrifugally applied enamels	0.025
Mortar lined, good finish	0.05
Mortar lined, average finish	0.1
Light rust	0.25
Heavy brush asphalts, enamels and tars	0.5
Heavy rust	1
Water mains with general tuberculations	1.2

HydrauCalc has a database of values of absolute roughness of pipe wall from recognized references:

- MILLER
- ISO 5167-1 2003
- Fluid Mechanics – F. White
- IDELCHIK
- Pipe Flow Guide

DATABASE – ROUGHNESS COEFFICIENT



Type of tubes	Coefficient
cast, plain	100
cast iron, old, unlined	40-120
cast iron (10 years old)	107-113
cast iron (20 years old)	89-100
cast iron (30 years old)	75-90
cast iron (40 years old)	64-83
cast iron, tar (asphalt) coated	100
cast iron, cement lined	140
cast iron, bituminous lined	140
cast iron, mitumastic	140-150
cast iron, sea-coated	100
Ductile Iron Pipe (DIP)	140
Ductile Iron, cement lined	120
galvanized, plain	120
wrought, plain	100

HydrauCalc has a database of values of Hazen-Williams roughness coefficients from:

- Hydraulic Tables by GARDNER S. WILLIAMS and ALLEN HAZEN - 2nd Ed. (1914)

DATABASE - HYDRAULIC RESISTANCE COEFFICIENT

Tables of hydraulic resistance coefficients

3-K Darby method | 2-K Hooper method | Crane method | Equivalent length method | Constant K method

Elbow

Component	K1	Ki	Kd
Elbow, 90°, threaded, standard, (r/D = 1)	800	0.14	4
Elbow, 90°, threaded, long radius, (r/D = 1.5)	800	0.071	4.2
Elbow, 90°, flanged, welded, bends, (r/D = 1)	800	0.091	4
Elbow, 90°, (r/D = 2)	800	0.056	3.9
Elbow, 90°, (r/D = 4)	800	0.066	3.9
Elbow, 90°, (r/D = 6)	800	0.075	4.2
Elbow, 90°, mitered, 1 weld, (90°)	1000	0.27	4
Elbow, 90°, 2 welds, (45°)	800	0.068	4.1
Elbow, 90°, 3 welds, (30°)	800	0.035	4.2
Elbow, 45°, threaded standard, (r/D = 1)	500	0.071	4.2
Elbow, 45°, long radius, (r/D = 1.5)	500	0.052	4
Elbow, 45°, mitered, 1 weld, (45°)	500	0.086	4
Elbow, 45°, mitered, 2 welds, (22.5°)	500	0.052	4
Elbow, 180°, threaded, close-return bend, (r/D = 1)	1000	0.23	4
Elbow, 180°, flanged, (r/D = 1)	1000	0.12	4
Elbow, 180°, all, (r/D = 1.5)	1000	0.1	4

Back

HydrauCalc has a database of coefficients allowing pressure losses to be calculated using old calculation methods.

Hydraulic resistance coefficients are given for the following calculation methods:

- 3-K Darby Method
- 2-K Hooper method
- Crane method
- Equivalent length method
- Constant K method

New R2024a

DATABASE - EQUIVALENCE NPS TO DN

Equivalence Nominal Pipe Size (NPS) to Nominal Diameter (DN)

Equivalence NPS to DN

NPS (in)	DN (mm)		NPS (in)	DN (mm)
⅛	6		34	850
¼	8		36	900
⅜	10		38	950
½	15		40	1000
¾	20		42	1050
1	25		44	1100
1¼	32		46	1150
1½	40		48	1200
2	50		50	1250
2½	65		52	1300
3	80		54	1350
3½	90		56	1400
4	100		58	1450
4½	115		60	1500
5	125		64	1600
6	150		68	1700
8	200		72	1800
10	250		80	2000
12	300		84	2100
14	350		88	2200
16	400		96	2400
18	450		104	2600
20	500		112	2800
22	550		120	3000
24	600		128	3200
26	650		136	3400
28	700		144	3600
30	750		152	3800
32	800		160	4000

Back

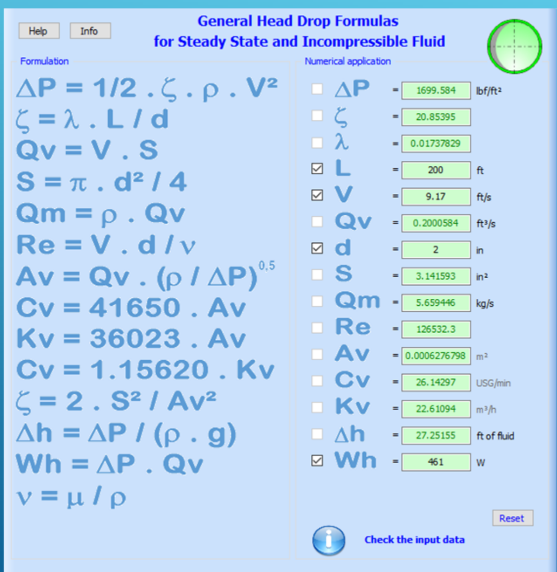
HydrauCalc has a correspondence table between the NPS (Nominal Pipe Size) in inches and the DN (Diameter Nominal) in millimeters.

Diameter Nominal (DN) is used in the metric system of units and Nominal Pipe Size (NPS) in the Imperial system of units.

New R2024a

THE TOOLS

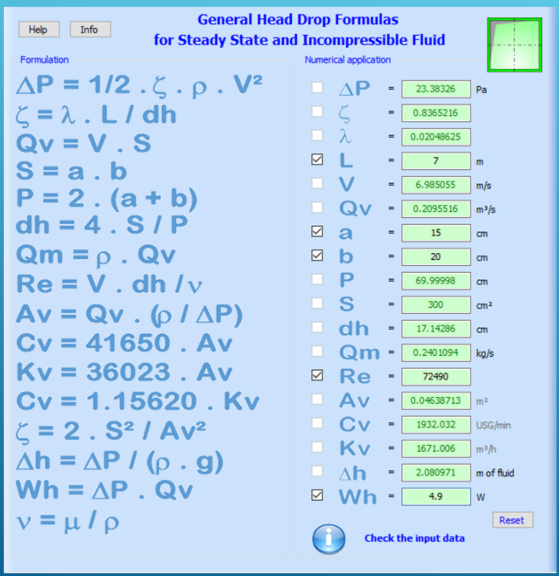
TOOL – CALCULATOR FOR CIRCULAR CROSS-SECTIONS



The application allows, from known input data and for circular cross-sections, to automatically calculate those that can be deduced.

It is thus possible to determine the volume flowrate corresponding, for example, to an imposed mean velocity, so as to inform the input data of the components.

TOOL – CALCULATOR FOR RECTANGULAR CROSS-SECTIONS



The application also makes it possible, from known input data and for rectangular cross-sections, to calculate those that can be deduced from it.

It is thus possible to determine the volume flowrate corresponding, for example, to an imposed Reynolds number, so as to inform the input data of the components.

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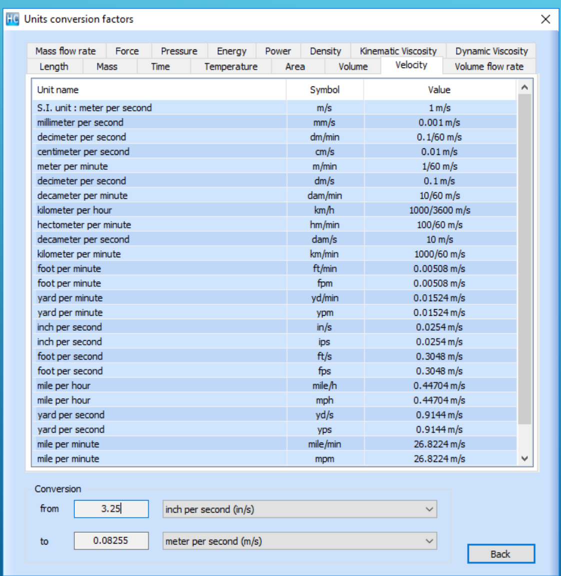
TOOL – UNITS CONVERSION



The application has a tool allowing:

- to view the conversion factors of the measurement units integrated in the application,
- to convert together units of measurement of the same physical size.

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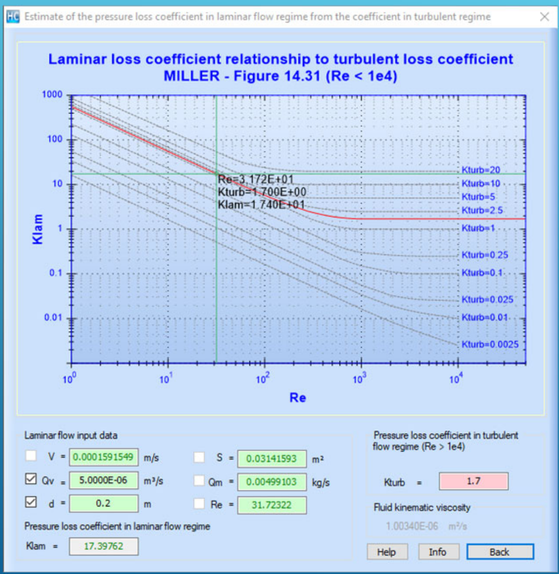
TOOL – ESTIMATE PRESSURE LOSS COEFFICIENT IN LAMINAR FLOW

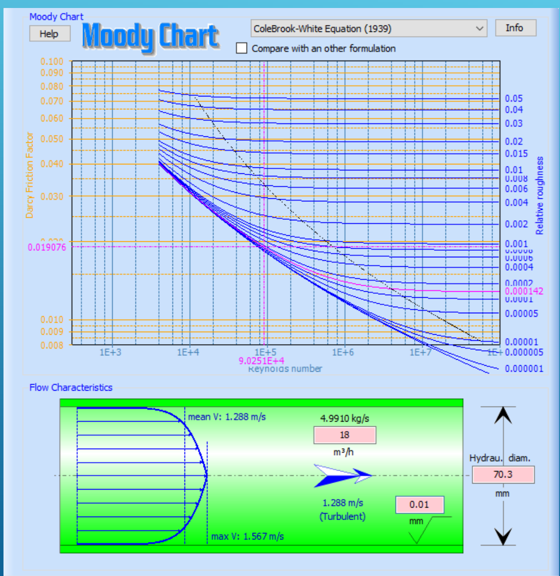


The application has a tool making it possible to obtain an estimate of the coefficient of pressure loss in the laminar flow regime, if the coefficient of pressure loss in the turbulent flow regime is known.

This method only applies to minor pressure losses (pipe fittings, valves, etc.) and is based on the following reference book:

- Internal Flow System, D.S. Miller

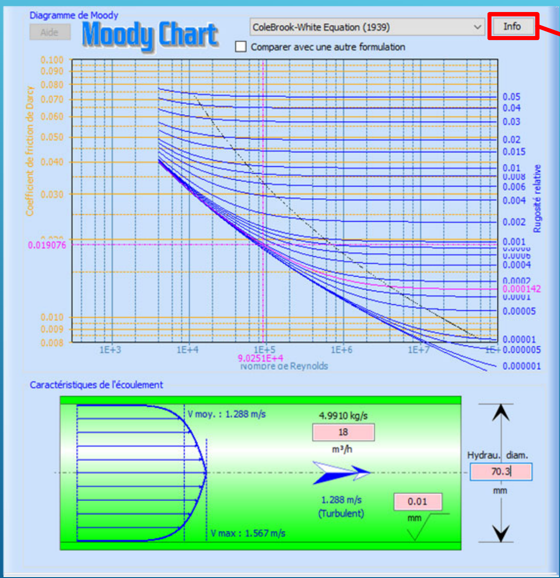
TOOL – MOODY DIAGRAM (1)

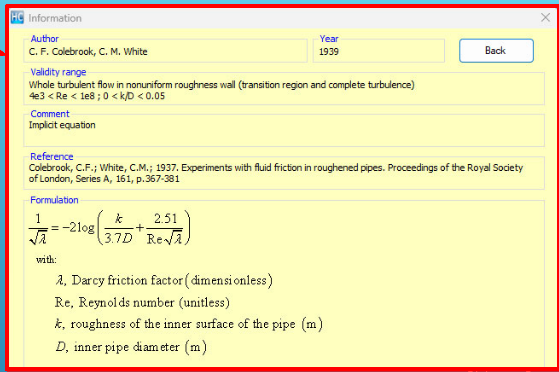


The application has a tool to calculate the coefficient of friction from more than 40 other formulations published by recognized scientists. The curves of iso-values of relative roughness are plotted in a Moody diagram and the calculated point is presented.

The velocity profile of the flow corresponding to the calculation point is also plotted in a pipe of same hydraulic diameter as that of the component.

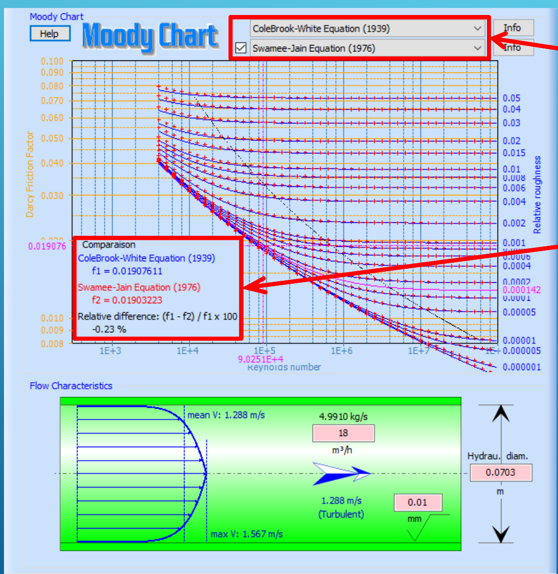
TOOL – MOODY DIAGRAM (2)





It is possible, for the selected formulation, to display the information relating to this formulation.

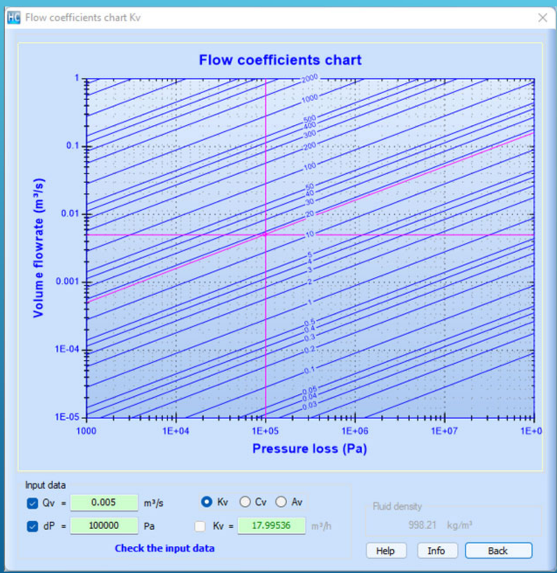
TOOL – MOODY DIAGRAM (3)



This tool also makes it possible to compare two different formulations for determining the Darcy friction

The relative difference found at the calculation point is calculated and displayed on the diagram.

TOOL – VALVE SIZING CHART

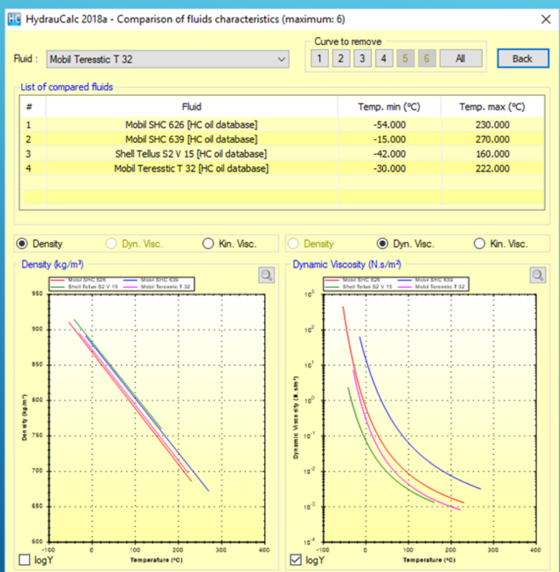


The application has a valve sizing aid chart.

The user selects the type of flow coefficient: Kv, Cv or Av.

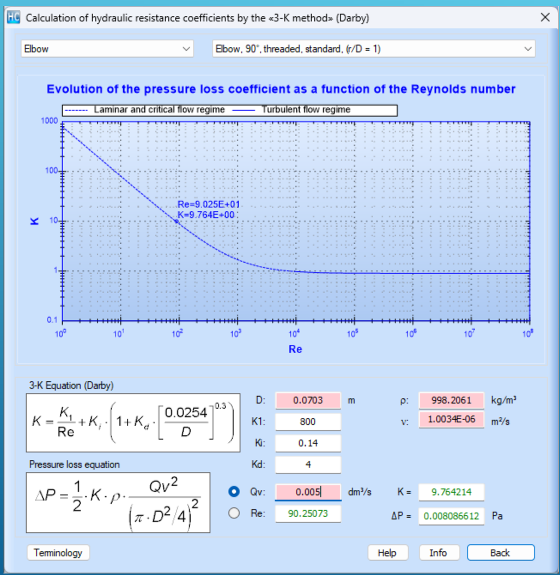
It then selects two of the three input data (volume flow, pressure loss or value of the flow coefficient) in order to calculate the third.

TOOL – FLUID COMPARATOR



The application has a tool to compare the characteristics of the fluids integrated in the application or defined by the user (density, dynamic viscosity and kinematic viscosity).

TOOL – CALCULATION BY THE 3K-DARBY METHOD



The application has a tool to calculate pressure loss coefficients using Darby's 3-K method. This method only applies to singular pressure losses (fittings, valves …).

New R2024a

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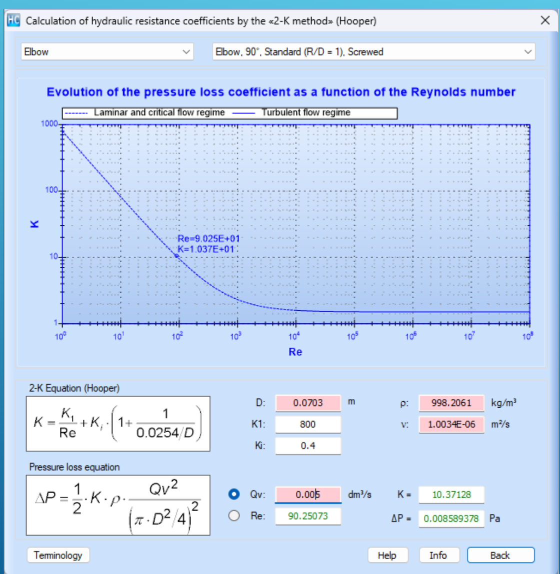
TOOL – CALCULATION BY THE 2K-HOOPER METHOD



The application has a tool to calculate pressure loss coefficients using Hooper's 2-K method. This method only applies to singular pressure losses (fittings, valves …).

New R2024a

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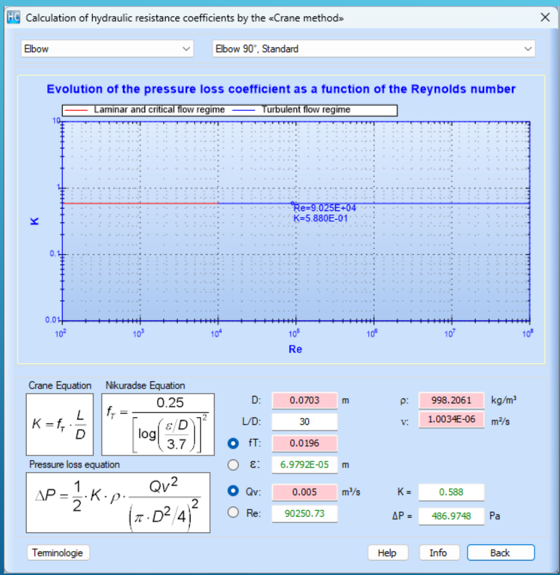
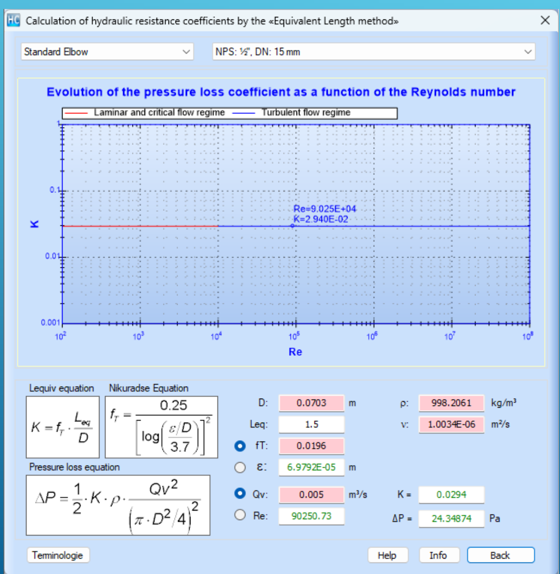
TOOL – CALCULATION BY THE CRANE METHOD



The application has a tool to calculate pressure loss coefficients using the Crane method. This method only applies to singular pressure losses (fittings, valves …).

New R2024a

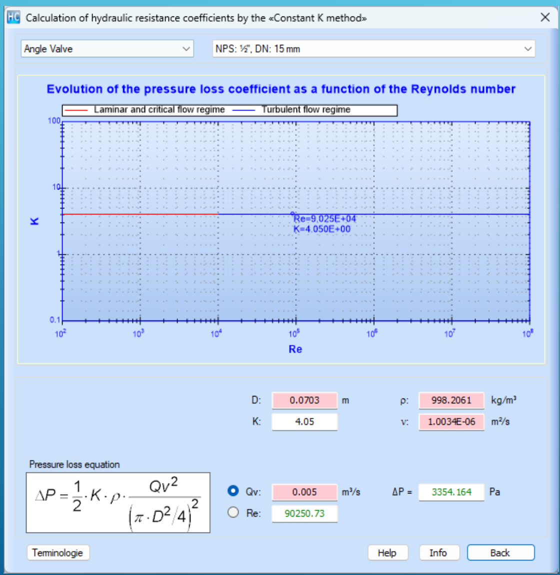
TOOL – CALCULATION BY THE EQUIVALENT LENGTH METHOD



The application has a tool to calculate pressure loss coefficients using the equivalent length method. This method only applies to singular pressure losses (fittings, valves …).

New R2024a

TOOL – CALCULATION BY THE CONSTANT K METHOD

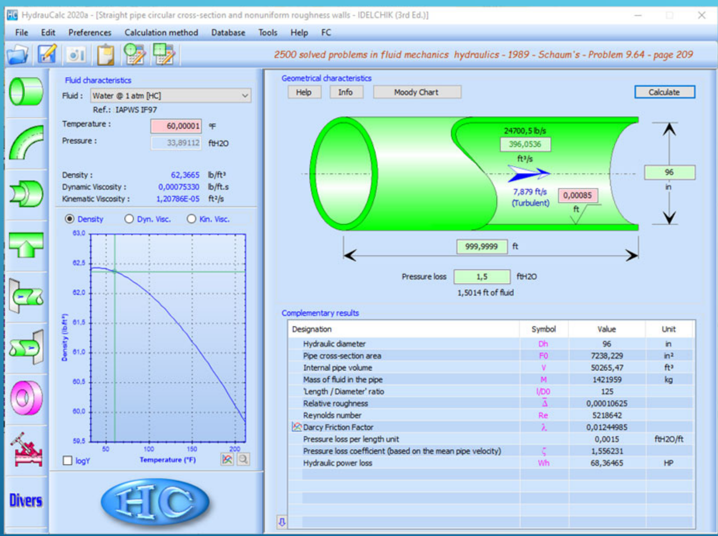


The application has a tool to calculate pressure loss coefficients using the constant K method. This method only applies to singular pressure losses (fittings, valves ...).

New R2024a

THE CALCULATION REPORT

CALCULATION REPORT



To include a calculation result in a document, it is possible to copy the window using the button and paste it into the document.

The screenshot contains all the data used for the calculation and the results:

- in the title bar:
  - the release of the application,
  - the type of component calculated and the calculation method used,
- in the fluid pane:
  - the characteristics of the fluid used,
- in the component pane:
  - the input data of the component,
  - the desired main result (value in green colour),
  - the additional results from the calculation.

SAVING COMPONENT DATA

SAVING COMPONENT DATA

Nom	Modifié le	Type
2500 SPiFMaHy (1989) - Problem 9.64 - page 209.HCspc	21/06/2017 20:44	Fichier HCSPC
2500 SPiFMaHy (1989) - Problem 9.68 - page 211.HCspc	23/10/2017 12:10	Fichier HCSPC
2500 SPiFMaHy (1989) - Problem 9.69 - page 211.HCspc	23/10/2017 12:10	Fichier HCSPC
2500 SPiFMaHy (1989) - Problem 9.103 - page 221.HCspt	11/06/2019 20:55	Fichier HCSPT
AFM - 7th Ed (2015) - Example Problem 8.11 - page 196.HCspc	07/09/2019 11:31	Fichier HCSPC
ChEDL - contraction_conical(Di1=0.0703, Di2=0.0431, l=0.01, method='Crane').HCtgc	25/11/2018 19:19	Fichier HCTGC
ChEDL - diffuser_conical(Di1=0.0431, Di2=0.0703, l=0.01, method='Miller').HCtge	23/11/2018 19:14	Fichier HCTGE
CRANE - Flow of Fluids - Edition 2013 - Example 7-35 – page 7-24.HCcsj	18/02/2019 18:44	Fichier HCCSJ
CRANE - Flow of Fluids - Edition 2013 - Example 7-36 – page 7-25.HCdsj	18/02/2019 18:44	Fichier HCDSJ
CRANE - SI units (1999) - Example - page 2-13.HChet	15/04/2021 17:35	Fichier HCHET
CRANE - SI units (1999) - Example 1 - page 3-12.HCspc	23/10/2017 12:10	Fichier HCSPC
CRANE - SI units (1999) - Example 1 page 3-14.HCfmn	13/04/2021 20:23	Fichier HCFMN
CRANE - SI units (1999) - Example 2 - page 3-12.HCspc	23/10/2017 12:10	Fichier HCSPC
CRANE - SI units (1999) - Example 4-12 - page 4-7.HCose	10/04/2018 15:47	Fichier HCOSE
CRANE - SI units (1999) - Example 4-23 - page 4-15.HCfmo	12/12/2018 18:33	Fichier HCFMO
Dimensionnement d'une pompe centrifuge - réf. CNAM.HCpud	24/09/2020 11:36	Fichier HCPUD

The application allows you to save component data in files. Each file corresponds to a calculation performed for a component.

This saved data can then be reloaded for a new calculation if, for example, data has changed.

Component types are differentiated by file extensions.

THE DATA EXPORT

DATA EXPORT

	A	B	C	D	E	F	G
1							
2							
3							
4		Straight pipe circular cross-section and nonuniform roughness walls - IDELCHIK (3rd Ed.)					
5		Diameter	0,3333598	m			
6		Pipe cross-section area	0,08728033	m²			
7		Length	609,6	m			
8		Absolute Roughness	4,60E-005	m			
9		Volume flow rate	25,57719	m³/s			
10		Pressure loss	1,00E+009	Pa			
11		Fluid head	102191,5	m of fluid			
12		Pressure loss coefficient	23,33955				
13		Darcy Friction Factor	0,01276324				
14		Flow velocity	293,0464	m/s			
15		Reynolds number	1,00E+008				
16		Hydraulic power loss	2,56E+010	W			
17		Density	997,9705	kg/m³			
18		Dynamic Viscosity	9,75E-004	N.s/m²			
19		Kinematic Viscosity	9,77E-007	m²/s			
20							
21							

Feuille1 / Feuille2 / Feuille3

For each component, the input data and the main results can be copied to the clipboard, using the button , for reuse in another application, for example a spreadsheet.

DATA EXPORT

Référence : Pipe Flow - A Practical and Comprehensive Guide (2012) - Example 7.4 - page 71

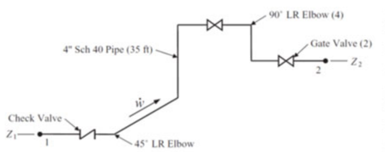


FIGURE 7.1. Four-inch pipe section.

Ktotal = N1.K1 + N2.K2 + N3.K3 + N4.K4 + N5.K5
K 4,394

dPtotal = N1.dP1 + N2.dP2 + N3.dP3 + N4.dP4 + N5.dP5
dP 15,216 psi

HydrauCalc result:
P1 - P2 = dP + dH
P1 - P2 17,380 psi

Reference result:
P1 - P2 17,41 psi

Relative difference:
0,174%

N1	Number	1	
	4" Schedule 40 Pipe (New, Clean Steel)		
	Straight pipe circular cross-section and nonuniform roughness walls -		
	Diameter	0,3355	ft
	Pipe cross-section area	0,0884	ft²
	Length	35	ft
	Absolute Roughness	1,50E-04	ft
	Volume flow rate	0,05681	m³/s
dP1	Pressure loss	6,15249	psi
	Fluid head	14,2205	ft of fluid
K1	Pressure loss coefficient	1,77655	
	Darcy Friction Factor	0,01703	
	Flow velocity	22,6954	ft/s
	Reynolds number	724116	
	Hydraulic power loss	3,27677	HP
rho	Density	62,3013	lb/ft³
	Dynamic Viscosity	2,04E-05	lbf.s/ft²
	Kinematic Viscosity	1,05E-05	ft²/s

N2	Number	1	
	45 ° LR Elbow		
	Smooth bend with circular cross-section - Pipe Flow - Guide (2012)		
	Diameter	0,3355	ft
	Passage cross-section area	0,0884	ft²
	Bend angle	45	°
	Radius of curvature	0,50325	ft
	Absolute Roughness	0,00015	ft
	Volume flow rate	0,05681	m³/s
dP1	Pressure loss	0,51601	psi
	Fluid head	1,19267	ft of fluid
K2	Pressure loss coefficient	0,149	
	Flow velocity	22,6954	ft/s
	Reynolds number	724116	
	Hydraulic power loss	0,27482	HP
	Density	62,3013	lb/ft³
	Dynamic Viscosity	2,04E-05	lbf.s/ft²
	Kinematic Viscosity	1,05E-05	ft²/s

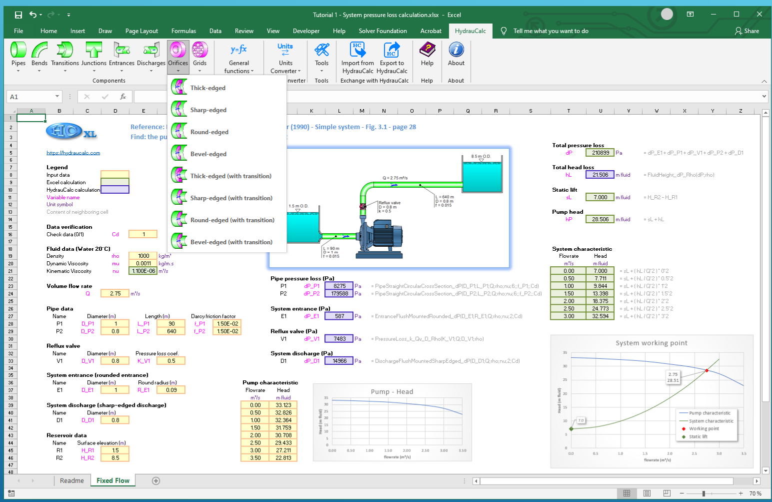
N3	Number	4	
	90 ° LR Elbow		
	Smooth bend with circular cross-section - Pipe Flow - Guide (2012)		
	Diameter	0,3355	ft
	Passage cross-section area	0,0884	ft²
	Bend angle	90	°
	Radius of curvature	0,50325	ft
	Absolute Roughness	0,00015	ft
	Volume flow rate	0,05681	m³/s
dP1	Pressure loss	0,75173	psi
	Fluid head	1,7375	ft of fluid
K3	Pressure loss coefficient	0,21706	
	Flow velocity	22,6954	ft/s
	Reynolds number	724116	
	Hydraulic power loss	0,40036	HP
	Density	62,3013	lb/ft³
	Dynamic Viscosity	2,04E-05	lbf.s/ft²
	Kinematic Viscosity	1,05E-05	ft²/s

Feuil1

Exporting the main data and results to a spreadsheet allows you to perform additional calculations such as:

- Calculation of the total pressure loss of the circuit by summing the pressure losses of each component.
- Search for the flow circulating in the circuit from the sum of the pressure loss coefficients and using the solver integrated into the spreadsheet.

Data exchange with HydrauCalcXL



HydrauCalcXL Add-in is a library of functions that has been developed to calculate the pressure losses of hydraulic components in Microsoft Excel®. This library allows the direct call of functions relating to the calculation of pressure losses. It comes from the HydrauCalc application.

The HydrauCalcXL functions can be used via the user interface of Excel, like the own integrated functions of Excel.

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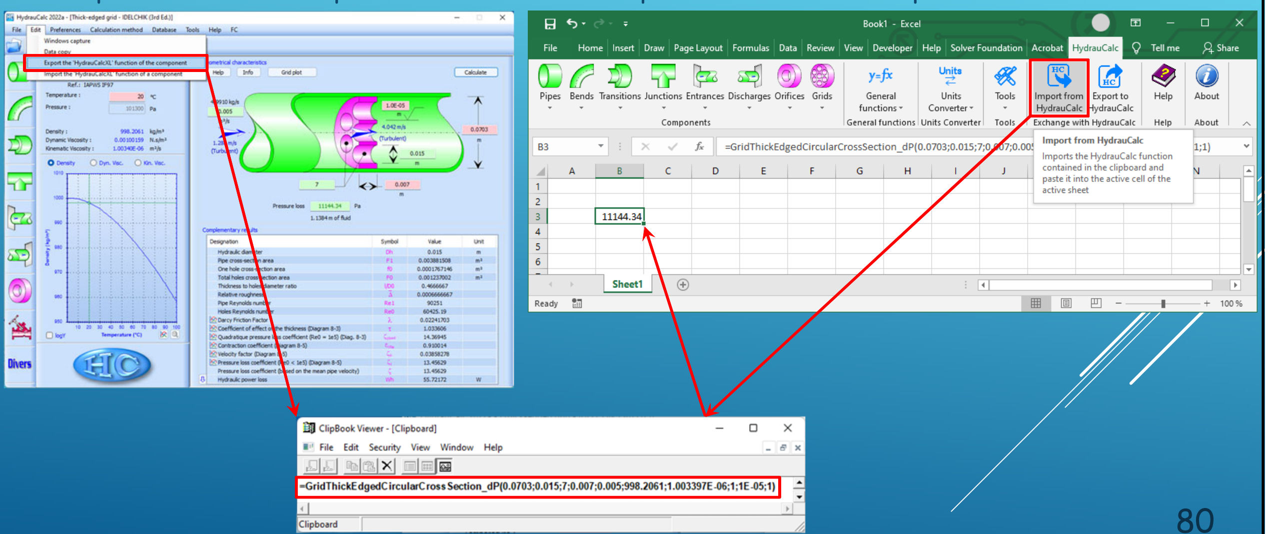
Data export from HydrauCalc to HydrauCalcXL

1 – Export function to Clipboard

2 – Import function from Clipboard



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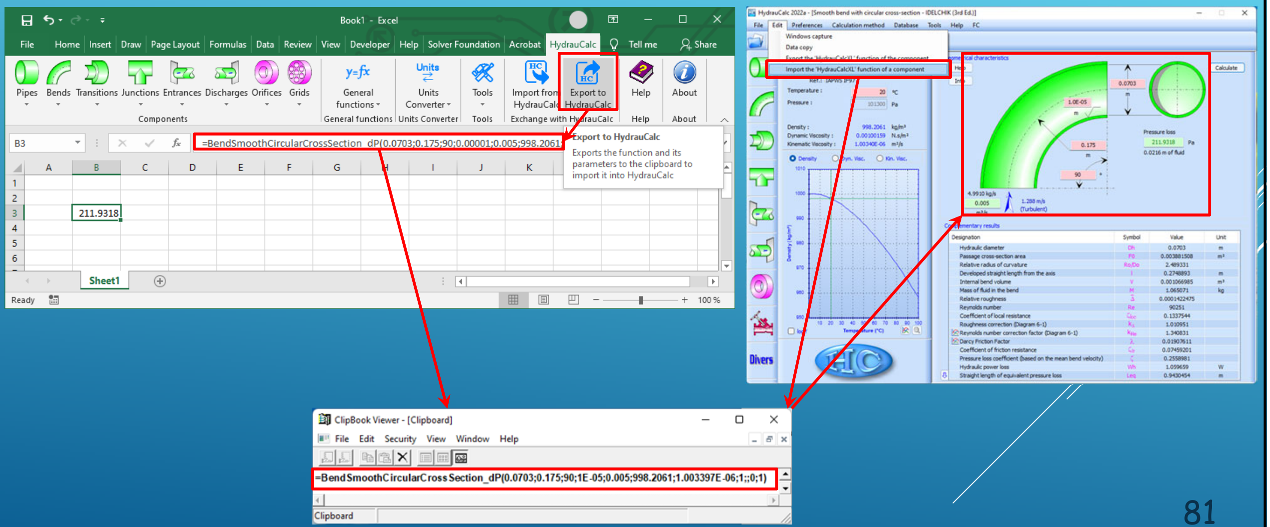
Data export from HydrauCalcXL to HydrauCalc

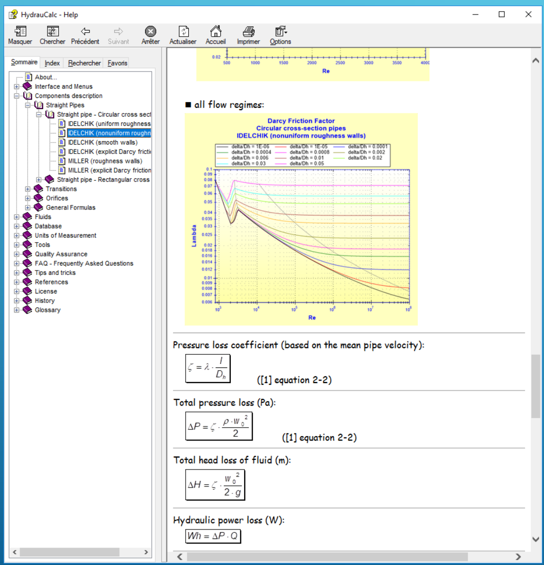
1 – Export function to Clipboard

2 – Import function from Clipboard



THE ASSURANCE QUALITY

TECHNICAL DOCUMENTATION



In general, each component has several calculation methods that come from different reference works. For all components, each calculation method is detailed in a technical document including:

- A description of the method used
- The mathematical formulation of the model
- The nomenclature used for the equations
- The range of the formulation
- An example of an application
- The bibliographic reference (s) used for modelling

COMPONENTS MODEL VALIDATION

HydrauCalc comes with a document that provides a comparison of software results with a series of examples published in well-known and respected references. Examples of hydraulic analysis include calculations of flow, pressure drop and pipe sizing for compressible and incompressible fluids.

The results obtained by the HydrauCalc application are very close to the published results.

At each new software release, a series of tests is performed to check the non-regression of the software features.

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