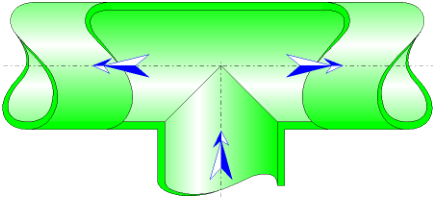




**Symmetric dividing sharp-edged T-junction
(standard threaded type)
Circular Cross-Section
(IDELCHIK)**



Model description:

This model of component calculates the minor head loss (pressure drop) generated by the flow in a symmetric dividing sharp-edged T-junction standard threaded type.

The head loss by friction in the inlet and outlet piping is not taken into account in this component.

Model formulation:

Cross-sectional area of the right branch (m²):

$$F_{1s} = \pi \cdot \frac{D_s^2}{4}$$

Cross-sectional area of the left branch (m²):

$$F_{2s} = \pi \cdot \frac{D_s^2}{4}$$

Cross-sectional area of the common branch (m²):

$$F_c = \pi \cdot \frac{D_c^2}{4}$$

Volume flow rate in the common branch (m³/s):

$$Q_c = Q_{1s} + Q_{2s}$$

Mean velocity in the right branch (m/s):

$$w_{1s} = \frac{Q_{1s}}{F_{1s}}$$

Mean velocity in the left branch (m/s):

$$w_{2s} = \frac{Q_{2s}}{F_{2s}}$$

Mean velocity in the common branch (m/s):

$$w_c = \frac{Q_c}{F_c}$$

Mass flow rate in the right branch (kg/s):

$$G_{1s} = Q_{1s} \cdot \rho$$

Mass flow rate in the left branch (kg/s):

$$G_{2s} = Q_{2s} \cdot \rho$$

Mass flow rate in the common branch (kg/s):

$$G_c = Q_c \cdot \rho$$

Reynolds number in the right branch:

$$Re_{1s} = \frac{w_{1s} \cdot D_s}{\nu}$$

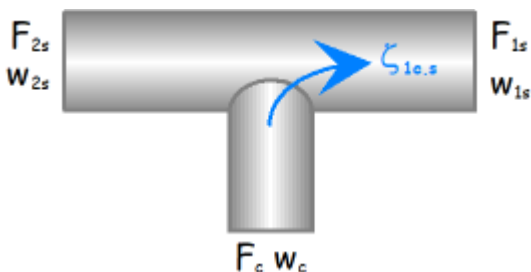
Reynolds number in the left branch:

$$Re_{2s} = \frac{w_{2s} \cdot D_s}{\nu}$$

Reynolds number in the common branch:

$$Re_c = \frac{w_c \cdot D_c}{\nu}$$

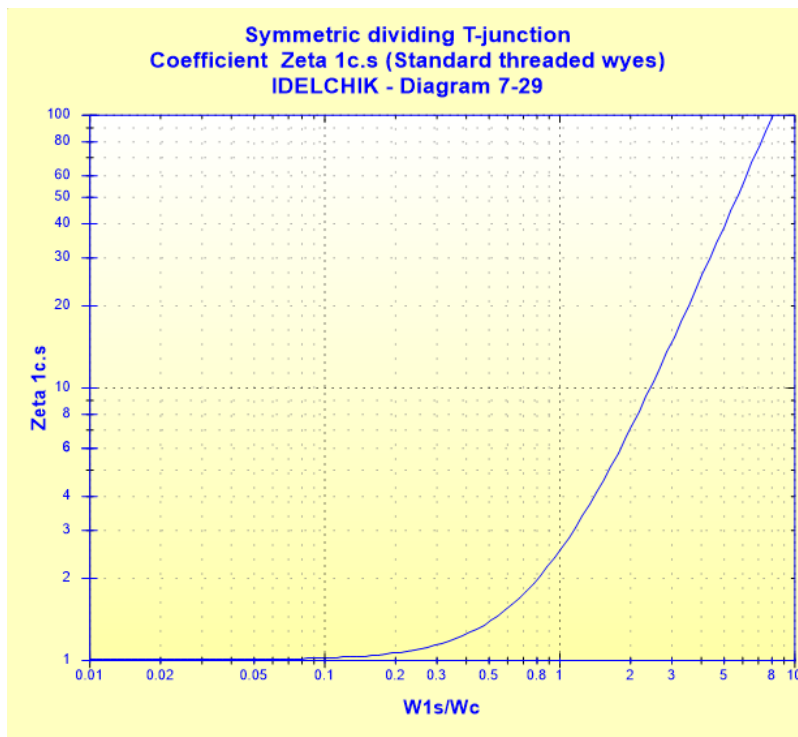
Pressure loss coefficient of the right branch (based on mean velocity in the common branch):



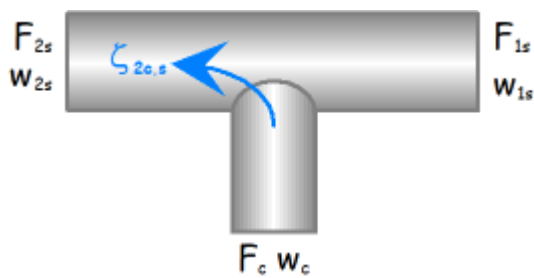
$$\zeta_{1c.s} = 1 + k_1 \cdot \left(\frac{w_{1s}}{w_c} \right)^2$$

([1] diagram 7.29 - Division of flow)

with: $k_1 = 1.5$



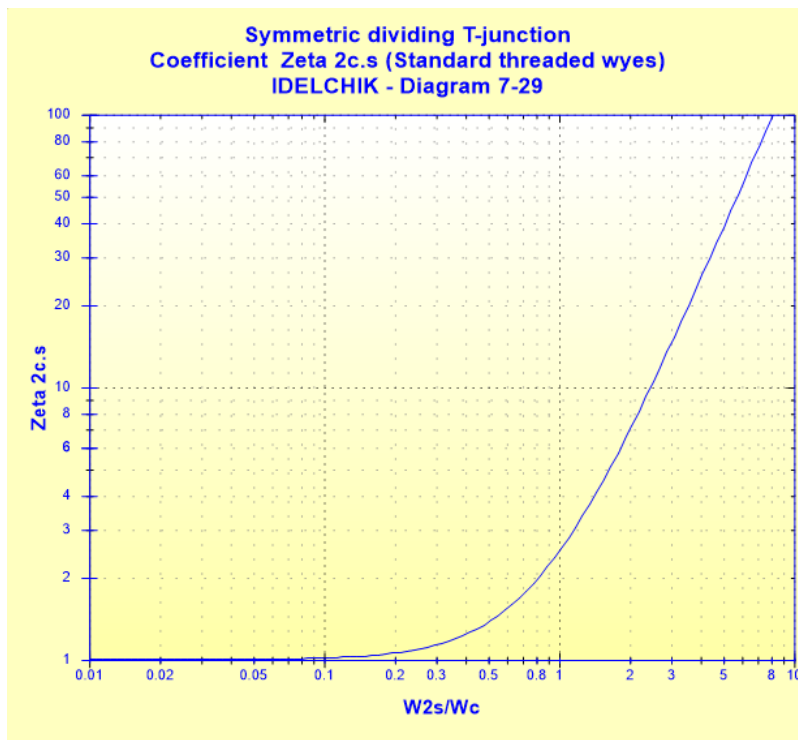
Pressure loss coefficient of the left branch (based on mean velocity in the common branch):



Note: for the left branch, the formulas are the same as those of the right branch, with subscript 2 instead of subscript 1.

$$\zeta_{2c.s} = 1 + k_2 \cdot \left(\frac{w_{2s}}{w_c} \right)^2 \quad ([1] \text{ diagram 7.29 - Division of flow})$$

with: $k_2 = 1.5$



Pressure loss in the right branch (Pa):

$$\Delta P_{1c.s} = \zeta_{1c.s} \cdot \frac{\rho \cdot W_c^2}{2}$$

Pressure loss in the left branch (Pa):

$$\Delta P_{2c.s} = \zeta_{2c.s} \cdot \frac{\rho \cdot W_c^2}{2}$$

Head loss of fluid in the right branch (m):

$$\Delta H_{1c.s} = \zeta_{1c.s} \cdot \frac{W_c^2}{2 \cdot g}$$

Head loss of fluid in the left branch (m):

$$\Delta H_{2c.s} = \zeta_{2c.s} \cdot \frac{W_c^2}{2 \cdot g}$$

Hydraulic power loss in the right branch (W):

$$Wh_{1s} = \Delta P_{1c.s} \cdot Q_{1s}$$

Hydraulic power loss in the left branch (W):

$$Wh_{2s} = \Delta P_{2c.s} \cdot Q_{2s}$$

Symbols, Definitions, SI Units:

- D_s Diameter of the right and left branches (m)
- D_c Diameter of the common branch (m)
- F_{1s} Cross-sectional area of the right branch (m²)

F_{2s}	Cross-sectional area of the left branch (m^2)
F_c	Cross-sectional area of the common branch (m^2)
Q_{1s}	Volume flow rate in the right branch (m^3/s)
w_{1s}	Mean velocity in the right branch (m/s)
Q_{2s}	Volume flow rate in the left branch (m^3/s)
w_{2s}	Mean velocity in the left branch (m/s)
Q_c	Volume flow rate in the common branch (m^3/s)
w_c	Mean velocity in the common branch (m/s)
G_{1s}	Mass flow rate in the right branch (kg/s)
G_{2s}	Mass flow rate in the left branch (kg/s)
G_c	Mass flow rate in the common branch (kg/s)
Re_{1s}	Reynolds number in the right branch ()
Re_{2s}	Reynolds number in the left branch ()
Re_c	Reynolds number in the common branch ()
$\zeta_{1c.s}$	Pressure loss coefficient of the right branch (based on mean velocity in the common branch) ()
$\zeta_{2c.s}$	Pressure loss coefficient of the left branch (based on mean velocity in the common branch) ()
ΔP_{1s}	Pressure loss in the right branch (Pa)
ΔP_{2s}	Pressure loss in the left branch (Pa)
ΔH_{1s}	Head loss of fluid in the right branch (m)
ΔH_{2s}	Head loss of fluid in the left branch (m)
Wh_{1s}	Hydraulic power loss in the right branch (W)
Wh_{2s}	Hydraulic power loss in the left branch (W)
ρ	Fluid density (kg/m^3)
ν	Fluid kinematic viscosity (m^2/s)
g	Gravitational acceleration (m/s^2)

Validity range:

- turbulent flow regime ($Re_c \geq 10^4$)
- diameter of common branch (D_c) \leq diameter of right and left branches (D_s)

Example of application:

HydrauCalc 2019a - [Symmetric dividing sharp-edged T-junction - IDELCHIK (3rd Ed.) (Standard threaded wyes)]

File Edit Preferences Calculation method Database Tools Help

Fluid characteristics

Fluid: Water @ 1 atm [HC]
Ref.: IAPWS IF97

Temperature: T 20 °C
Pressure: P 1.013 bar

Density: ρ 998.2061 kg/m³
Dynamic Viscosity: μ 0.00100159 N.s/m²
Kinematic Viscosity: ν 1.00340E-06 m²/s

Density Dyn. Visc. Kn. Visc.

Density (kg/m³) vs Temperature (°C)

logY

Geometrical characteristics

Help Info Calculate

Left branch pressure loss ΔP_{2s} 0.08490886 bar
 ΔH_{2s} 0.8674 m of fluid

Right branch pressure loss ΔP_{1s} 0.09683476 bar
 ΔH_{1s} 0.9892 m of fluid

Complementary results

Designation	Symbol	Value	Unit
Right branch cross-section area	F1s	0.003881508	m ²
Left branch cross-section area	F2s	0.003881508	m ²
Common channel cross-section area	Fc	0.001458963	m ²
Cross-sections area ratio 'Common branch / Right channel'	Fc/F1s	0.3758754	
Cross-sections area ratio 'Common branch / Common channel'	Fc/F2s	0.3758754	
Flow rate ratio 'Left branch / Common channel'	Q1s/Qc	0.8333333	
Flow rate ratio 'Right branch / Common channel'	Q2s/Qc	0.1666667	
Right branch Reynolds number	Re1s	90251	
Left branch Reynolds number	Re2s	18050.2	
Common channel Reynolds number	Rec	176649.1	
Coefficient 'k' (Diagram 7-29)	k	1.5	
<input checked="" type="checkbox"/> Right branch pressure loss coefficient (based on wc)	ζ_{1cs}	1.147169	
<input checked="" type="checkbox"/> Left branch pressure loss coefficient (based on wc)	ζ_{2cs}	1.005887	
Right branch hydraulic power loss	Wh1s	48.41738	W
Left branch hydraulic power loss	Wh2s	8.490886	W

References:

[1] Handbook of Hydraulic Resistance, 3rd Edition, I.E. Idelchik

HydrauCalc

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