

Reynolds number, R (u is flow speed (m/s)) $Re > 2900$ (Above 2900 it's turbulent flow, below 2300 it's laminar, which's worse for heat transfer)

Haaland Eq. approximation of Darcy-weisbach friction factor

		u m/s (minimum for turbulent flow)			ρ Pa (corresponding lossless pressure)			ε/D			(at higher Re, f goes higher, in an obtuse proportion)			
		D_H, m, hydraulic diameter	20 °C	25 °C (linear interp)	30 °C	20 °C	25 °C (linear interp)	30 °C	D	@ ε= 0.001E-3 m	@ ε= 0.002E-3 m	f=		
4	1.778	0.001778	1.637255271	1.469978372	1.302281475	1337.889867	1077.122932	844.3223	0.001778	0.00056243	0.001125	0.0452	0.045609	
6	3.175	0.003175	0.916862952	0.823187888	0.729277626	419.5622622	337.785714	264.7795	0.003175	0.000314961	0.00063	0.04503	0.045247	
8	4	0.004	0.727759968	0.653405386	0.578864116	264.3406144	212.8182181	166.8214	0.004	0.00025	0.0005	0.044987	0.045156	
10	4.572	0.004572	0.636710383	0.571658256	0.506442796	202.3351959	162.8982212	127.6907	0.004572	0.000218723	0.000437	0.044967	0.045113	
0.07	1.778	6	0.006	0.485173312	0.435603591	0.38590941	117.4847175	94.58587473	74.14285	0.006	0.000166667	0.000333	0.044934	0.045042
0.125	3.175	6.35	0.00635	0.458431476	0.411593944	0.364638813	104.8905656	84.44643785	66.19486	0.00635	0.00015748	0.000315	0.044929	0.04503
0.25	6.35	7.874	0.007874	0.369702803	0.3319306	0.294063559	68.21706917	54.92094033	43.05077	0.007874	0.000127	0.000254	0.04491	0.04499
0.375	9.525	8	0.008	0.363879984	0.326702693	0.289432058	66.08515359	53.20455454	41.70535	0.008	0.000125	0.00025	0.044909	0.044987
0.18	4.572	9.525	0.009525	0.305620984	0.274395963	0.243092542	46.61802914	37.53175016	29.41994	0.009525	0.000104987	0.00021	0.044897	0.044962
0.31	7.874	10	0.01	0.291103987	0.261362155	0.231545646	42.2944983	34.0509149	26.69142	0.01	0.0001	0.0002	0.044894	0.044955

1 meter and pressure drop at velocity for $e=0.0023$ -

P_sum kPa, Sum of major losses -

	20 m, 20°C	25°C (linear inter. 30°)	
0.001778	35.65761953	28.70762433	2.50299
0.003175	6.398791539	5.151608718	0.438181
0.004	2.48476027	2.61531847	0.205005
0.004572	2.298811355	1.77024772	1.387637
0.006	0.992446798	0.804655503	0.630736
0.00635	0.84874991	0.62848649	0.535605
0.007874	0.457991203	0.38724863	0.289032
0.008	0.4377099	0.352396297	0.276232
0.009525	0.26667319	0.214696153	0.168293
0.01	0.232430954	0.187128041	0.146584
psi			
0.001778	5.17170047	4.12688888	3.263783
0.003175	0.92806249	0.74777674	0.585689
0.004	0.41515614	0.37932868	0.297337
0.004572	0.318910625	0.25675236	0.20126
0.006	0.144957503	0.11670396	0.091481
0.00635	0.123094252	0.0910206	0.077683
0.007874	0.066426066	0.05347902	0.041912
0.008	0.063484462	0.051110762	0.040064
0.009525	0.038677616	0.031139044	0.024499
0.01	0.033711216	0.021740628	0.021275

Darcy Weisbach eq. for pressure lost to friction, known as major losses

$$\frac{\Delta p}{L} = f_D \cdot \frac{\rho}{2} \cdot \frac{\langle v \rangle^2}{D},$$

		$\Delta p/L, \text{ Pa/m}$					
		@ $\epsilon = 0.001\text{E-}3 \text{ m}$			@ $\epsilon = 0.002\text{E-}3 \text{ m}$		
$D, \text{ m}$	20°C	$25^\circ\text{C (line: } 30^\circ\text{C)}$		30°C	20°C	$25^\circ\text{C (line: } 30^\circ\text{C)}$	
0.001778		34011.27012	27382.16	21464.00314	34319.73	27630.5	21658.67
0.003175		5950.515402	4790.706	3755.281141	5979.229	4813.823	3773.402
0.004		2972.998448	2393.534	1876.21479	2984.135	2402.5	1883.243
0.004572		1990.039528	1602.163	1255.884139	1996.476	1607.345	1259.946
0.006		879.8522467	708.361	555.2615742	881.9621	710.0596	556.5931
0.00635		742.1426386	597.4923	468.3551032	743.814	598.8382	469.4011
0.007874		389.0832649	313.2474	245.5446206	389.7745	313.8039	245.9809
0.008		370.9771595	298.6703	234.1181288	371.6248	299.1917	234.5268
0.009525		219.7388026	176.9097	138.6738667	220.0552	177.1644	138.8735
0.01		189.8774066	152.8686	119.8287873	190.1365	153.0771	119.9923