

Hydraulic piping calculation



The following table shows the properties of the main secondary fluids as well as the maximum recommended cooling capacity for the different hydraulic pipe diameters.

Fluid	Nominal diameter	Inches	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/8"	1 1/4"	1 1/2"	2"	2 1/2"	3"	3 1/2"	4"	5"	6"
		DN	10	15	20	25	32	40	50	65	80	100	125	150	175	200	225	250
Copper (DIN 1057)			15.0	18.0	22.0	28.0	35.0	42.0	54.0	64.0	76.0	88.9	108.0	133.0	159.0			
Galvanised steel (DIN EN 10255)			17.2	21.3	26.9	33.7	42.4	48.3	60.3		76.1	88.9	114.3	139.7	168.3			
Carbon steel / Stainless steel (DIN EN 10220/10216)			17.2	21.3	26.9	33.7	42.4	48.3	60.3		76.1	88.9	114.3	139.7	168.3			
PEX, PB, 10 bar, SDR 9			20.0	25.0	32.0	40.0	50.0	63.0	75.0	90.0	110.0	125.0	160.0	200.0				
PE, PB class 2, 10 bar, SDR 11			16.0	20.0	22.0	25.0	28.0	32.0	40.0	50.0	63.0	75.0	90.0					
ABS, PP-R, 10 bar, SDR 17					25.0		32.0	40.0	50.0	63.0	75.0	90.0	110.0	140.0	160.0			

Fluid	%	Fluid temp. (°C)	Frozen temp (°C)	Density (kg/m³)	Specific heat (kJ/kg·K)	Viscosity (mPa·s)	Duct W/mK	Max. recommended cooling capacity(kW)																
								(calculated for a temperature difference of 5 K and a pressure drop of 400 Pa/m)																
Water		7	0	1 000	4.21	1.4	0.58	1.4	2.6	3.5	4.7	6.9	8.7	12	17	29	57	93	153	236	396	666	967	
Ethanol	30 %	-10	-17	975	3.65	12.7	0.45	0.4	0.9	1.4	2.2	3.8	4.9	6.8	10	17	35	58	96	150	254	450	747	
Propylene glycol	15 %	5	-4	1 015	4.04	2.9	0.51	1.2	2.2	3.0	4.1	6.0	7.5	10	15	26	50	82	135	210	353	619	943	
Propylene glycol	25 %	0	-9	1 026	3.91	5.6	0.46	1.0	1.8	2.6	3.5	5.1	6.5	8.9	13	22	44	73	120	187	315	555	915	
Propylene glycol	30 %	-5	-13	1 033	3.84	9.1	0.44	0.6	1.4	2.2	3.0	4.5	5.7	7.9	12	20	40	66	110	171	290	512	847	
Propylene glycol	35 %	-10	-17	1 040	3.76	16	0.43	0.3	0.8	1.3	2.0	3.4	4.8	6.9	10	18	36	59	98	154	263	466	773	
Propylene glycol	40 %	-15	-22	1 047	3.68	28	0.41		0.4	0.7	1.1	1.9	2.6	4.1	7	15	31	52	86	136	233	416	694	
Propylene glycol	45 %	-20	-27	1 055	3.59	54	0.40			0.4	0.5	1.0	1.3	2.1	3.6	7.9	21	43	74	117	202	363	610	
Propylene glycol	50 %	-25	-32	1 062	3.51	110	0.38				0.5	0.6	1	1.7	3.8	10	22	45	86	169	307	520		
Propylene glycol	55 %	-30	-39	1 070	3.41	239	0.37					0.8	1.7	4.7	9.7	20	39	85	196	412				
Propylene glycol	60 %	-40	-46	1 079	3.30	969	0.37								0.8	1.7	4.7	9.7	20	39	85	196	412	
Hot propylene glycol	50 %	20	-32	1 038	3.63	6.1	0.38	0.9	1.7	2.3	3.2	4.7	5.9	8.2	12	20	41	67	111	172	291	512	845	
Ethylene glycol	10 %	5	-3	1 018	4.02	2.1	0.54	1.3	2.3	3.2	4.3	6.3	7.9	11	16	27	52	86	141	218	366	640	940	
Ethylene glycol	20 %	0	-8	1 036	3.82	3.4	0.50	1.1	2.0	2.8	3.8	5.6	7.0	9.6	14	24	47	77	127	197	331	581	910	
Ethylene glycol	30 %	-5	-15	1 056	3.62	5.8	0.47	0.9	1.7	2.4	3.2	4.8	6.1	8.3	12	21	41	68	112	175	296	520	858	
Ethylene glycol	35 %	-10	-19	1 066	3.51	8.6	0.45	0.6	1.4	2.1	2.9	4.3	5.4	7.5	11	19	38	62	103	161	273	481	795	
Ethylene glycol	40 %	-15	-23	1 077	3.39	13	0.44	0.4	0.9	1.4	2.2	3.8	4.8	6.6	9.7	17	34	56	94	147	249	441	731	
Ethylene glycol	45 %	-20	-28	1 088	3.27	21	0.43		0.6	0.9	1.4	2.4	3.3	5.2	8.4	15	30	50	84	132	225	399	663	
Ethylene glycol	50 %	-25	-34	1 100	3.15	34	0.42			0.5	0.8	1.4	2.0	3.1	5.3	12	26	44	74	116	199	356	595	
Ethylene glycol	55 %	-30	-40	1 112	3.01	57	0.41				0.5	0.8	1.1	1.8	3	6.7	18	37	63	101	174	312	524	
Alkali	18 %	-10	-28	942	4.25	2.7	0.44	1.2	2.2	3.1	4.1	6.1	7.6	10	15	26	51	83	137	213	358	627	919	
Alkali	21 %	-20	-37	939	4.27	4.3	0.41	1.1	2.0	2.8	3.8	5.6	7.0	10	14	24	48	78	129	201	339	596	921	
Alkali	25 %	-30	-45	933	4.30	7.4	0.37	0.8	1.7	2.5	3.4	5.0	6.3	9	13	22	44	72	120	187	316	557	921	
Calcium chloride	15 %	0	-11	1 086	4.04	2.4	0.55	1.3	2.3	3.3	4.4	6.4	8.1	11	16	27	54	88	144	223	375	657	1 009	
Calcium chloride	20 %	-5	-17	1 117	3.99	3.5	0.54	1.2	2.2	3.0	4.1	6.0	7.6	10	15	26	51	83	137	213	359	630	1 024	
Calcium chloride	25 %	-20	-29	1 143	3.96	9.9	0.51	0.6	1.5	2.4	3.3	4.9	6.2	8.5	12	22	43	71	118	185	313	553	916	
Calcium chloride	30 %	-30	-55	1 278	3.93	25	0.48	0.3	0.6	1.0	1.6	2.8	3.8	6.1	10	19	38	64	107	168	286	509	848	
Sodium chloride	10 %	0	-7	1 078	4.12	2.0	0.60	1.4	2.5	3.4	4.6	6.7	8.4	11	17	28	56	91	149	231	388	679	1 021	
Sodium chloride	15 %	-5	-12	1 120	4.08	2.6	0.59	1.3	2.4	3.3	4.4	6.5	8.2	11	16	28	54	89	147	227	382	669	1 051	
Sodium chloride	20 %	-10	-17	1 161	4.05	4.1	0.56	1.2	2.2	3.1	4.1	6.1	7.7	10	15	26	52	85	139	217	365	641	1 056	
Lithium chloride	10 %	-5	-12	1 056	3.60	3.0	0.59	1.1	2.0	2.7	3.7	5.4	6.8	9.3	13	23	45	75	122	190	320	561	873	
Lithium chloride	15 %	-15	-25	1 082	3.35	6.0	0.56	0.8	1.6	2.2	3.0	4.5	5.6	7.8	11	19	39	64	105	163	276	486	802	
Potassium formate Freezium	25 %	-5	-15	1 155	3.12	2.7	0.51	1.0	1.8	2.6	3.4	5.0	6.3	8.7	12	21	42	69	113	176	295	517	827	
Hycool20, Freezium	30 %	-10	-20	1 206	2.93	3.8	0.50	0.9	1.7	2.3	3.1	4.6	5.7	7.9	11	20	39	63	104	162	272	478	787	
Hycool30, Freezium	35 %	-25	-30	1 269	2.73	7.1	0.45	0.7	1.4	1.9	2.6	3.9	4.9	6.7	9.7	17	33	55	91	142	240	423	698	
Tyfoxit F15	25 %	-5	-15	1 232	3.17	3.6	0.52	1.0	1.8	2.5	3.4	5.0	6.4	8.7	13	22	43	70	115	178	300	527	867	
Tyfoxit F40	40 %	-25	-40	1 354	2.65	11	0.44	0.5	1.0	1.7	2.4	3.5	4.5	6.2	9	16	31	52	86	134	228	402	665	
Potassium acetate Tyfoxit	60 %	-10	-20	1 162	3.20	6.4	0.48	0.8	1.6	2.2	3.0	4.4	5.6	7.6	11	19	38	63	103	161	272	479	790	
Tyfoxit	70 %	-25	-31	1 193	3.10	17	0.45	0.3	0.7	1.1	1.7	3.0	4.1	6	8.9	16	31	52	87	136	231	410	681	
Tyfoxit	80 %	-35	-40	1 222	3.00	44	0.43		0.3	0.4	0.7	1.1	1.6	2.5	4.4	9.4	25	42	70	112	192	344	576	
Potassium acetate-formate Temper -10	0	-10	1 090	3.54	2.8	0.51		1.1	2.0	2.8	3.7	5.5	6.9	9.4	14	23	46	75	124	192	323	566	887	
Temper -15	-5	-15	1 120	3.39	3.8	0.49		1.0	1.8	2.5	3.4	5.0	6.4	9.4	13	22	43	70	115	180	302	530	873	
Temper -20	-10	-20	1 149	3.23	5.1	0.47		0.9	1.7	2.3	3.1	4.6	5.8	8	12	20	39	65	107	167	281	494	814	
Temper -30	-20	-30	1 190	3.00	10	0.44		0.5	1.1	1.8	2.5	3.8	4.8	6.6	9.6	17	33	55	92	143	242	428	708	
Temper -40	-30	-40	1 225	2.88	24	0.41			0.5	0.8	1.2	2.0	2.8	4.4	7.6	14	28	46	77	121	206	367	611	
Temper -55	-45	-55	1 267	2.62	58	0.38				0.3	0.4	0.8	1.1	1.7	2.9	6.5	18	35	59	94	162	292	490	
Temper -60	-50	-60	1 288	2.59	108	0.38					0.4	0.6	0.9	1.6	3.5	9.5	20	41	79	141	256	434		
Betaine (Thermara AC)	-5	-15	1 075	3.12	8.1	0.4		0.6	1.3	1.9	2.6	3.9	4.9	6.8	9.9	17	34	56	93	145	246	433	716	
Betaine (Thermara R)	-20	-35	1 110	2.80	48	0.3			0.3	0.5	0.9	1.2	2	3.4	7.4	20	36	61	97	167	299	501		

Flow velocities of the given fluid for the different pipe sections:

Laminar flow regime

> 0.5 m/s

> 1 m/s

> 1.5 m/s

> 2 m/s

> 2.5 m/s