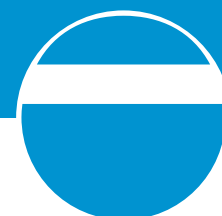


TECHNICAL DATA SHEET

VALSIR® SUPPLY SYSTEMS

PEXAL

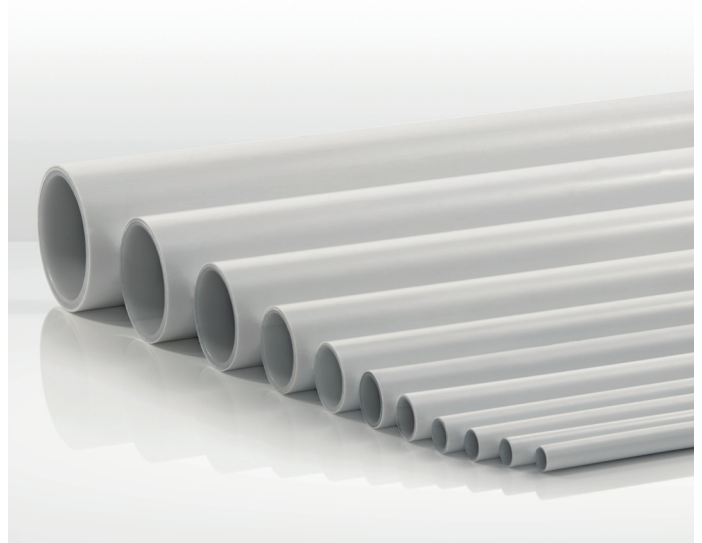


valsir®
QUALITY FOR PLUMBING

The product

Pexal® is an innovative pipe capable of responding to different installation techniques and different applications, from hot and cold potable water distribution, to centralized distribution, from convector and radiator heating systems to floor, wall and ceiling heating and air cooling systems, from compressed air distribution systems to industrial installations.

The Pexal Gas® pipe with an outer yellow layer is suitable and is certified for transporting fuel gas inside buildings (for more details, please refer to the dedicated documentation).



The Pexal® multilayer pipes combine the advantages of synthetic materials and in particular of the crosslinked polyethylene such as resistance to abrasion and corrosion, chemical resistance and hygiene with those of aluminium such as resistance to high temperatures and pressures, dimensional stability, impermeability to oxygen and light, and low thermal expansion.

The result is a product consisting of different layers of materials that combined together allow excellent properties to be obtained which can not be reached by a pipe made of only one material.

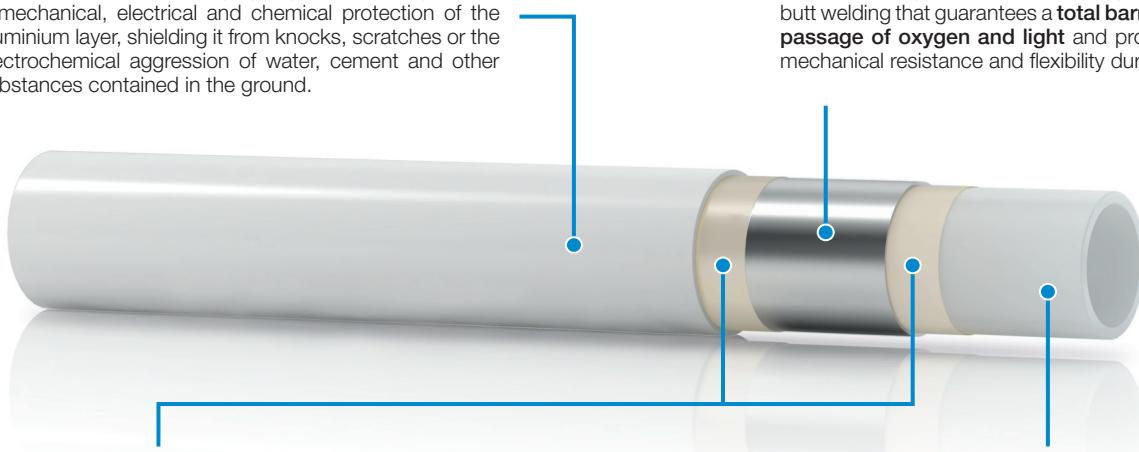
Figure Layering of the pipe.

External layer

Produced with crosslinked polyethylene PE-Xb it provides a mechanical, electrical and chemical protection of the aluminium layer, shielding it from knocks, scratches or the electrochemical aggression of water, cement and other substances contained in the ground.

Intermediate layer

This is made up of an aluminium alloy with longitudinal butt welding that guarantees a **total barrier against the passage of oxygen and light** and provides excellent mechanical resistance and flexibility during installation.



Bonding layers

These are made up of a powerful adhesive that bonds the intermediate aluminium layer with the internal and external layers.

Internal layer

The internal layer of the pipe is made up of a crosslinked polyethylene PE-Xb pipe that has been approved for the transport of consumable liquids and drinking water. It is also characterised by an **extremely smooth surface** that reduces pressure loss.

Features

The characteristics of the Pexal® pipes make this product highly reliable and extremely easy to install.

Durability and mechanical strength

The system has a durability of at least 50 years guaranteed by the product standards at pressures of 10 bar and temperatures up to 95°C. For operating temperatures lower than 95°C, the pipes can withstand pressures above 10 bar while maintaining a high degree of reliability over time. The mechanical characteristics of the Pexal® pipes are such that the bursting pressure at room temperature (in relation to the pipe diameter) is more than 100 bar!

Resistance to corrosion

The total resistance to corrosion, to building materials and to the main chemical compounds allows them to be used for various applications, even industrial ones.

Smoothness and resistance to scale formation

The extreme smoothness of the inner surface (roughness of 0.007 mm) prevents the formation of deposits such as limescale and also ensures low pressure drops over time.

Resistance to abrasion

Crosslinked polyethylene is abrasion resistant, and this is a synonym of durability, since the pipes are not affected by the abrasive action of impurities that are carried by the water at high speed.

Flexibility and shape stability

The combination of crosslinked polyethylene and aluminium guarantees excellent flexibility features in bending (also manual bending). The Pexal® pipe can be bent manually up to the 32 mm diameter and mechanically for the larger diameters, with curvature radii of up to 2.5 times the diameter.

The excellence of the Pexal® pipes resides also in its extraordinary shape stability: once bent and installed, it maintains the configuration over time allowing a reduction of the number of anchoring clips needed, which in surface mounting is reduced by 40% of the clips required for plastic pipes such as PE-X, PE-RT, PP-R, PB, PVC-C etc. Thanks to these features, the Pexal® pipes are also the ideal solution in areas subjected to earthquakes.

Thermal expansion

Thermal expansion is about 8 times lower than that of plastic pipes and is comparable to that of metal pipes. A 10 m Pexal® pipe subjected to a 50°C temperature difference will expand by 13 mm in contrast to a plastic pipe (crosslinked polyethylene) that expands by 90 mm.

Lightweight

The pipes are extremely lightweight compared to metal pipes: the weight is 1/3 compared to that of a corresponding copper pipe and 1/10 compared to that of a corresponding steel pipe.

Acoustic insulation

Crosslinked polyethylene is elastic and absorbs vibrations and therefore offers excellent acoustic insulation.

Oxygen and light barrier

The butt-welded aluminium layer represents a permanent oxygen and light barrier, avoiding in this way the two main causes of algae formation and corrosion in plastic pipes.

Thermal conductivity

The thermal conductivity of the pipe is 0.42 - 0.52 W/m·K (in relation to the diameter), approximately 900 times lower than that of copper, an aspect which is extremely important to ensure reduced temperature losses.

Hygiene

Non-toxic materials are used for the pipes and fittings and the system is certified for drinking water distribution.

Ecology

Pexal® is manufactured with fully recyclable materials, the production processes are energetically efficient in order to have a low impact on the environment. Valsir adopts Green Building principles, with an eye on environmental protection and conservation of resources.

Technical data

Table Typical technical data.

Features	Values	Testing methods
Material	Crosslinked polyethylene internal layer PE-Xb, internal bonding layer, intermediate aluminium layer, external bonding layer, crosslinked polyethylene external layer PE-Xb	-
Colour	RAL White 9003	-
Dimensions	14÷90 mm	-
Application	Hot and cold potable water distribution, convector and radiator heating systems, radiant heating and cooling systems, compressed air distribution systems, industrial installations.	-
Fittings	Pexal® Brass, Bravopress®, Pexal Easy® and Pexal® Twist	-
Minimum operating temperature ⁽¹⁾	-60°C	-
Maximum temperature ⁽²⁾	+95°C/+100°C	EN ISO 21003-1
Maximum pressure	+10 bar	EN ISO 21003-1
Density at 23°C	> 0.950 g/cm ³ (crosslinked polyethylene)	-
Softening temperature	135°C	-
Thermal expansion coefficient	0.026 mm/m·K	-
Thermal conductivity	0.42÷0.52 W/m·K	-
Internal roughness	0.007 mm	-
Oxygen permeability	0 mg/l	-
UV Resistance	Yes, if protected with UV-resistant paint	-
Halogen levels	Halogen-free	-
Reaction to fire	B-s2,d0 (combined with protective sheaths) ⁽³⁾ C-s2,d0 (pipe)	EN 13501-1 (LNE P126686) EN 13501-1

(1) At any rate above the freezing temperature of the transported fluid.

(2) For more details see the "Application fields" section.

(3) Comparable M1 according Arrêté du 21.11.2002.

Application fields

The conditions of use of the Pexal® pipes are shown in the technical data tables outlined above; however, according to the international standard EN ISO 21003-1 there are four classes of application or fields of use that need to be ascertained by performing laboratory tests in combination with the operating pressure p_D chosen by the producer which can be 4, 6, 8, 10 bar. These application fields are given in the table below.

The Pexal® pipes are certified for all four classes of application for pressures up to 10 bar.

Table Application fields and operating conditions in compliance with EN ISO 21003-1.

Application fields	Operating temperature T_D	Duration of T_D	Maximum operating temperature T_{max}	Duration of T_{max}	Malfunctioning temperature	Duration of T_{mal}	Typical application
	[°C]	[years]	[°C]	[years]	[°C]	[hours]	
1 ^a	60	49	80	1	95	100	Domestic hot water (60°C)
2 ^a	70	49	80	1	95	100	Domestic hot water (70°C)
4 ^a	20 + 40 + 60	2.5 + 20 + 25	70	2.5	100	100	Floor heating and low temperature systems
5 ^a	20 + 60 + 80	14 + 25 + 10	90	1	100	100	High temperature heating systems

Range

The range of Pexal® pipes is extremely wide: they are produced in a 14 mm diameter to 90 mm diameter and are available in coils or straight lengths, without sheath, with 6 and 10 mm insulating sheath or with corrugated protective sheath.

Pipe dimensions	Pexal® pipe in coils	Pexal® pipe in straight lengths	Pexal® pipe with 6 mm insulating sheath	Pexal® pipe with 10 mm insulating sheath	Pexal® pipe with 6 mm corrugated protective sheath
14x2	100 m	5 m	50 m (grey)	-	50 m (red, blue)
16x2	100 m, 200 m	5 m	50 m (grey, red, blue)	50 m (blue)	50 m (red, blue)
16x2.25	100 m	5 m	50 m (grey)	50 m (blue)	-
18x2	100 m	5 m	50 m (grey)	-	50 m (red, blue)
20x2	100 m	5 m	50 m (grey, red, blue)	50 m (blue)	50 m (red, blue)
20x2.5	100 m	5 m	50 m (grey)	50 m (blue)	-
26x3	50 m	5 m	50 m (grey, red, blue)	50 m (blue)	-
32x3	50 m	5 m	-	25 m (grey)	-
40x3.5	-	5 m	-	-	-
50x4	-	5 m	-	-	-
63x4.5	-	5 m	-	-	-
75x5	-	5 m	-	-	-
90x7	-	5 m	-	-	-

Pexal® pipe features

Pexal® pipes without insulation are suitable for a multitude of applications and if necessary can be suitably insulated once the installation has been completed.



Table Pexal® pipe features (diameters from 14 to 26 mm).

External diameter	[mm]	14	16	16	18	20	20	26
Thickness	[mm]	2	2	2.25	2	2	2.5	3
Internal diameter	[mm]	10	12	11.5	14	16	15	20
Water volume	[l/m]	0.078	0.113	0.104	0.154	0.201	0.176	0.314
Weight	[g/m]	97	113	120	130	156	177	286
Weight with water	[g/m]	175	226	224	284	357	353	599
Operating temperature	[°C]	0÷80	0÷80	0÷80	0÷80	0÷80	0÷80	0÷80
Maximum operating temperature	[°C]	95	95	95	95	95	95	95
Maximum operating pressure	[bar]	10	10	10	10	10	10	10
Thermal expansion coefficient	[mm/m·K]	0.026	0.026	0.026	0.026	0.026	0.026	0.026
Thermal conductivity	[W/m·K]	0.44	0.44	0.43	0.44	0.47	0.45	0.47
Internal roughness	[mm]	0.007	0.007	0.007	0.007	0.007	0.007	0.007
Oxygen permeability	[mg/l]	0	0	0	0	0	0	0

Table Pexal® pipe features (diameters from 32 to 90 mm).

External diameter	[mm]	32	40	50	63	75	90
Thickness	[mm]	3	3.5	4	4.5	5	7
Internal diameter	[mm]	26	33	42	54	65	76
Water volume	[l/m]	0.53	0.854	1.383	2.286	3.312	4.528
Weight	[g/m]	390	545	833	1232	1603	2403
Weight with water	[g/m]	919	1397	2213	3513	4908	6922
Operating temperature	[°C]	0÷80	0÷80	0÷80	0÷80	0÷80	0÷80
Maximum operating temperature	[°C]	95	95	95	95	95	95
Maximum operating pressure	[bar]	10	10	10	10	10	10
Thermal expansion coefficient	[mm/m·K]	0.026	0.026	0.026	0.026	0.026	0.026
Thermal conductivity	[W/m·K]	0.50	0.49	0.50	0.51	0.52	0.47
Internal roughness	[mm]	0.007	0.007	0.007	0.007	0.007	0.007
Oxygen permeability	[mg/l]	0	0	0	0	0	0

Multilayer Pexal® insulated pipe features

Pexal® pipes that are covered in the factory with thermal insulating sleeves are suitable in all applications that require a certain degree of insulation against condensation and against energy loss combined with an extremely practical and economic installation.



Table Multilayer Pexal® insulated pipe features.

Pipe	Insulation thickness	External diameter of the insulated pipe	Weight	Thermal conductivity of the insulated pipe
	[mm]	[mm]	[g/m]	[W/m·K]
14x2	6	26	105	0.059
16x2	6	28	121	0.058
16x2	10	36	133	0.053
16x2.25	6	28	138	0.060
16x2.25	10	36	150	0.054
18x2	6	30	139	0.057
20x2	6	32	166	0.057
20x2	10	40	179	0.052
20x2.5	6	32	199	0.061
20x2.5	10	40	212	0.054
26x3	6	38	304	0.063
26x3	10	46	320	0.056
32x3	10	52	430	0.055

The features of the material used for the production of the insulating sheath are indicated in the table.

Table Features of the material used for the production of the insulating sheath.

Features	Unit	Value
Material	-	High density closed cell polyethylene
Fire resistance class (EN 13501-1)	-	B _L -s1,d0
Density	[kg/m ³]	33
Thermal conductivity	[W/m·K]	0.0397
Traction resistance	[N/mm ²]	>0.18
Ultimate elongation	[%]	>80
Steam permeability	[mg/Pa·s·m]	<0.15

Features of the multilayer Pexal® pipe with corrugated protective sheath

Pexal® pipes that are covered in the factory with a protective corrugated insulating sleeve are generally used in domestic water supply systems that require protection or the possibility of removing or replacing the pipes.

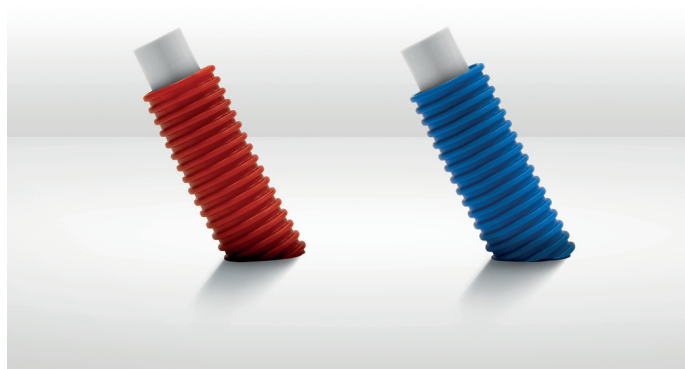


Table Features of the multilayer Pexal® pipe with corrugated protective sheath.

Pipe	Sheath thickness	External diameter of the pipe including the sheath	Weight	Crushing
	[mm]	[mm]	[g/m]	[N/m]
14x2	0.75	24.5	146	320
16x2	0.85	26.5	172	320
18x2	0.95	28.5	199	320
20x2	1.05	30.5	235	320

The features of the material used for the production of the corrugated protective sheath are indicated in the table.

Table Features of the material used for the production of the corrugated protective sheath.

Features	Unit	Value
Material	-	High density polyethylene
Flame-retardant	-	No
Density	[kg/m ³]	961
Thermal conductivity	[W/m·K]	0.38
Traction resistance	[N/mm ²]	> 22
Ultimate elongation	[%]	> 350
Steam permeability	-	> 100,000

Connection systems

The Pexal® pipes can be matched with different types of Valsir fittings.

Pexal® pipe	Pexal® Brass Multi-press brass fittings	Bravopress® PPSU press-fittings	Pexal Easy® Full bore PPSU fittings	Pexal® Twist Brass compression fittings
14x2	•		•	•
16x2	•	•	•	•
16x2.25	•		•	•
18x2	•			•
20x2	•	•	•	•
20x2.5	•		•	•
26x3	•	•	•	•
32x3	•	•	•	•
40x3.5	•		•	
50x4	•		•	
63x4.5	•		•	
75x5	•		•	
90x7	•			

Approvals:

The approvals of Valsir® supply systems are available on the website: www.valsir.com

Potability

The Pexal® system is suitable for domestic water supply systems; it received a potability certification from international institutes that ran tests to verify the absence of foreign substances, the non-proliferation of biofilm and organoleptic tests. Performed both at low and high temperatures, such tests in fact, assess whether the water is contaminated with molecules migrating from the pipe and conferring odour and flavour.

The Pexal® pipes passed these tests successfully, thus obtaining certifications in the main countries of interest: Austria, Australia, Germany, France, Hungary, Italy, Holland, Poland, Romania, Russia, Ukraine, Great Britain, South Africa.

Marking

The marking of the Pexal® pipes contains all the information required by current regulations as well as all the data necessary to trace the product.

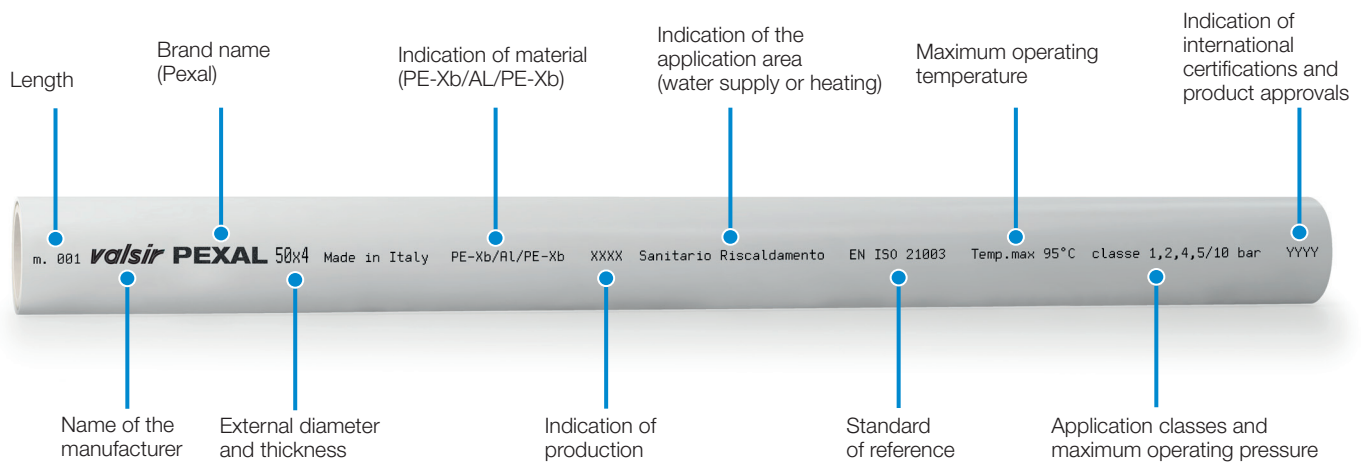


Figure Continuous pressure losses for conveyance of water at 10°C.

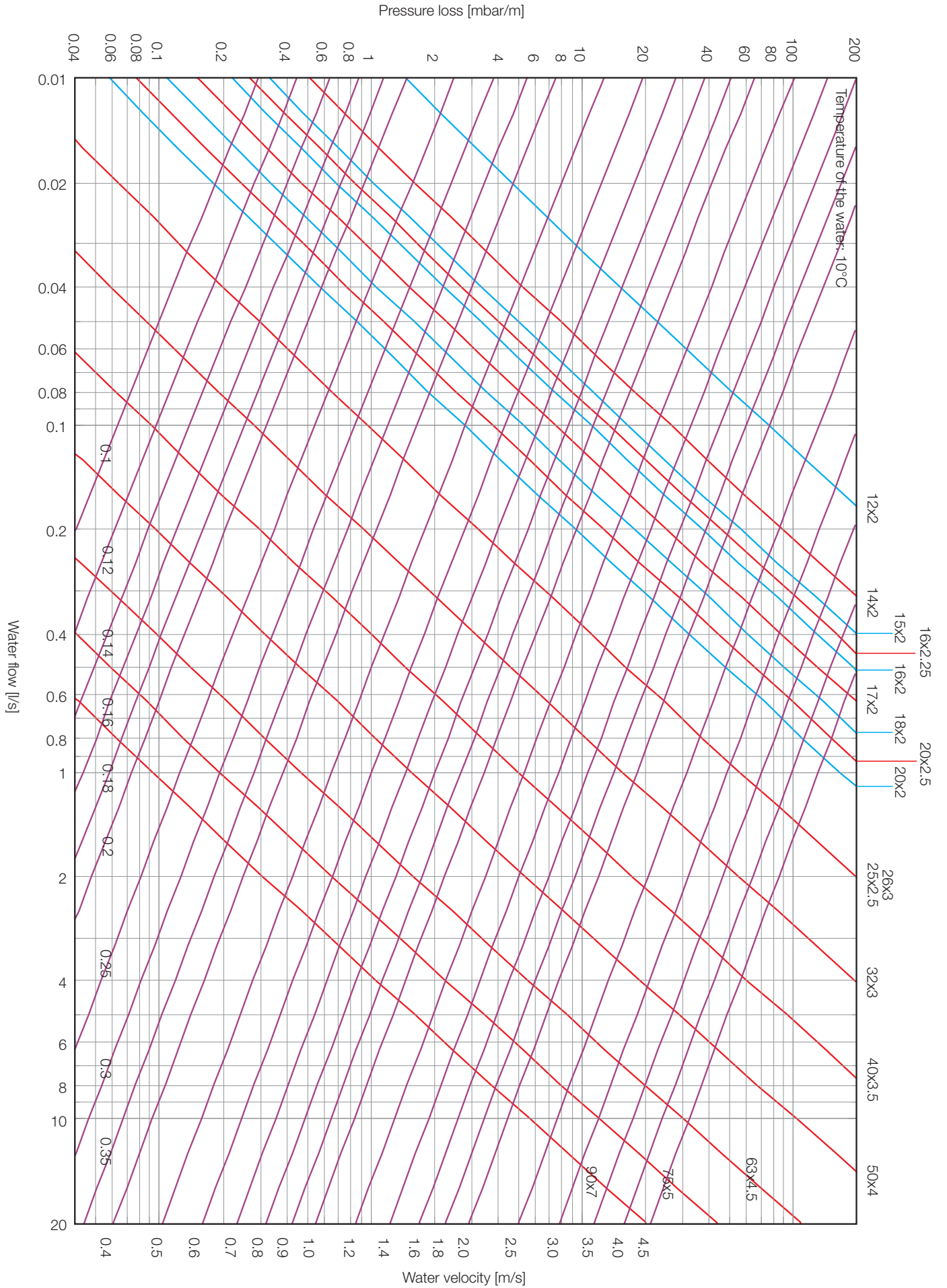


Figure Continuous pressure losses for conveyance of water at 60°C.

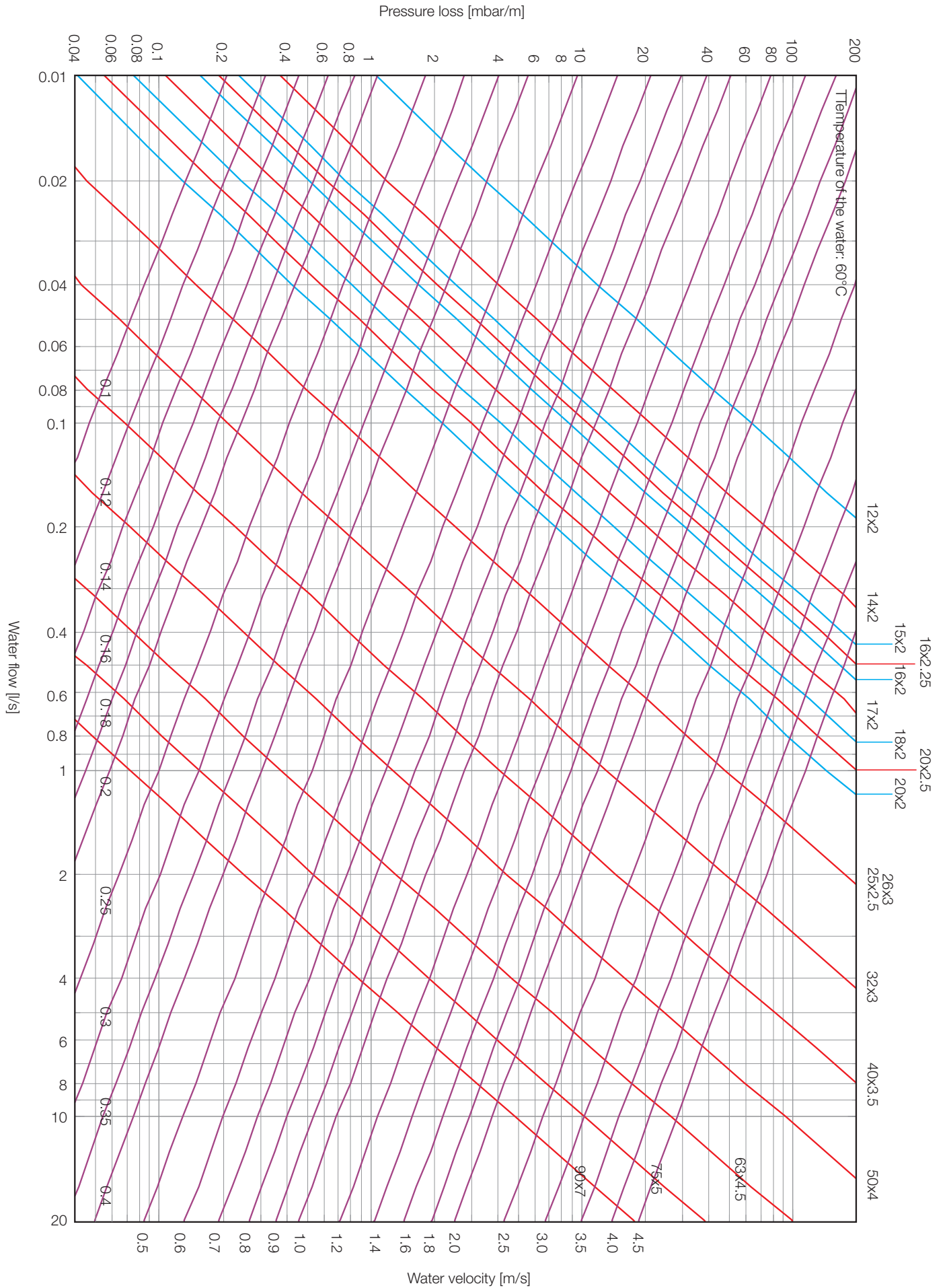


Figure Continuous pressure losses for conveyance of water at 80°C.

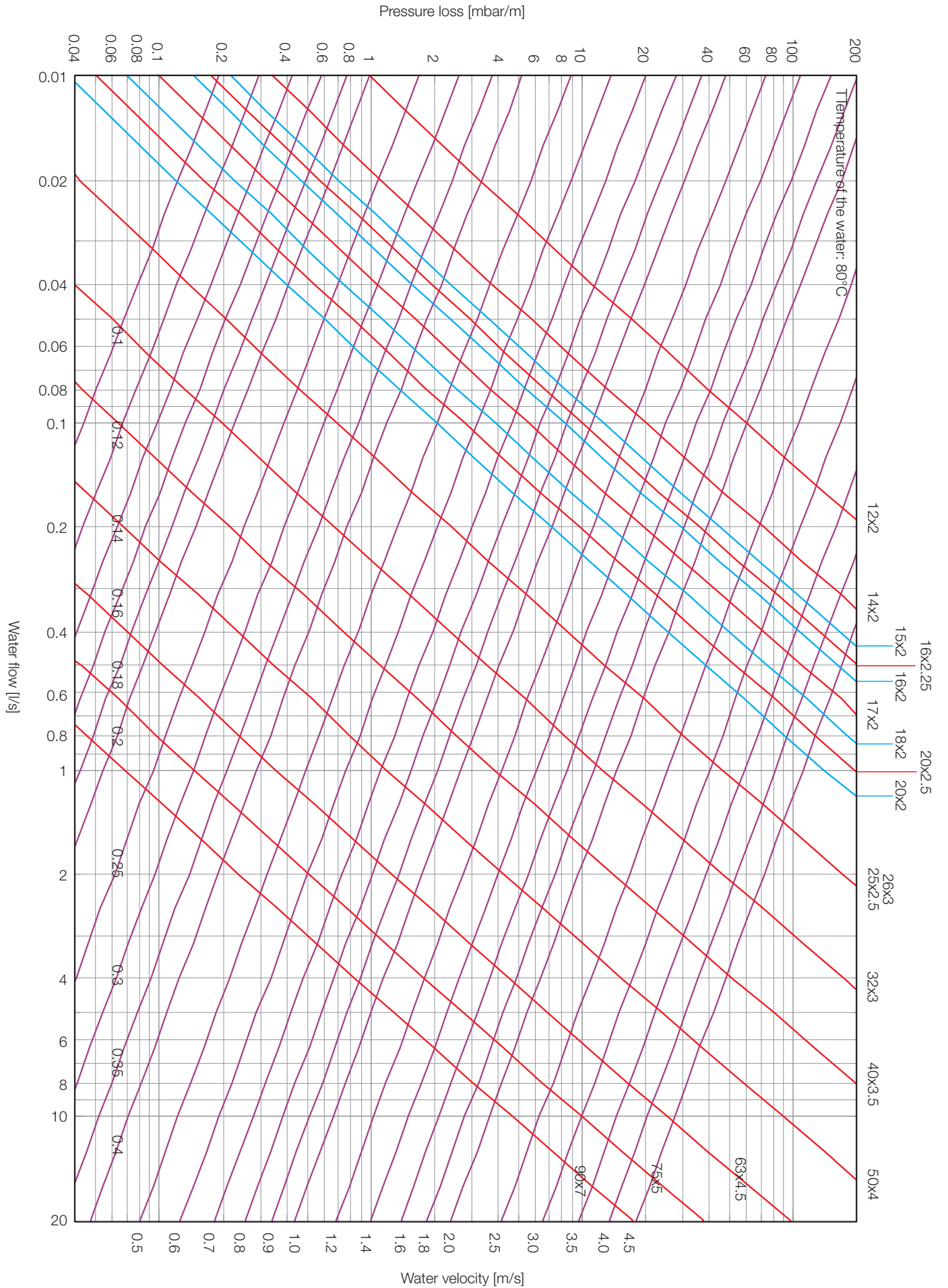


Table Continuous pressure losses for conveyance of water at 10°C.

Pipe Q	12x2		14x2		15x2		16x2.25		16x2		17x2		18x2		20x2.8		20x2.5		
	v	J	v	J	v	J	v	J	v	J	v	J	v	J	v	J	v	J	
0.01	0.2	1.5	0.1	0.5	0.1	0.3	0.1	0.3	0.1	0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
0.02	0.4	4.7	0.3	1.6	0.2	1.0	0.2	0.8	0.2	0.7	0.2	0.5	0.1	0.3	0.1	0.3	0.1	0.2	0.2
0.03	0.6	9.3	0.4	3.2	0.3	2.1	0.3	1.7	0.3	1.4	0.2	0.9	0.2	0.7	0.2	0.6	0.2	0.5	0.5
0.04	0.8	15.3	0.5	5.3	0.4	3.4	0.4	2.7	0.4	2.2	0.3	1.5	0.3	1.1	0.2	0.9	0.2	0.8	0.8
0.05	1.0	22.5	0.6	7.8	0.5	4.9	0.5	4.0	0.4	3.3	0.4	2.2	0.3	1.6	0.3	1.4	0.3	1.1	1.1
0.06	1.2	30.9	0.8	10.7	0.6	6.8	0.6	5.5	0.5	4.5	0.5	3.1	0.4	2.2	0.4	1.9	0.3	1.6	1.6
0.07	1.4	40.5	0.9	13.9	0.7	8.8	0.7	7.2	0.6	5.9	0.5	4.0	0.5	2.8	0.4	2.5	0.4	2.0	2.0
0.08	1.6	51.2	1.0	17.6	0.8	11.2	0.8	9.0	0.7	7.4	0.6	5.0	0.5	3.5	0.5	3.1	0.5	2.6	2.6
0.09	1.8	63.0	1.1	21.6	0.9	13.7	0.9	11.1	0.8	9.1	0.7	6.2	0.6	4.3	0.6	3.8	0.5	3.1	3.1
0.10	2.0	76.0	1.3	26.0	1.1	16.5	1.0	13.3	0.9	10.9	0.8	7.4	0.6	5.2	0.6	4.6	0.6	3.8	3.8
0.15	3.0	156.7	1.9	53.2	1.6	33.7	1.4	27.2	1.3	22.2	1.1	15.1	1.0	10.6	0.9	9.3	0.8	7.6	7.6
0.20	4.0	263.4	2.5	89.0	2.1	56.1	1.9	45.3	1.8	36.9	1.5	25.1	1.3	17.6	1.2	15.4	1.1	12.6	12.6
0.25	5.0	395.3	3.2	132.9	2.6	83.7	2.4	67.5	2.2	54.9	1.9	37.3	1.6	26.1	1.5	22.8	1.4	18.7	18.7
0.30	6.0	552.0	3.8	184.9	3.2	116.2	2.9	93.6	2.7	76.2	2.3	51.7	1.9	36.1	1.8	31.6	1.7	25.9	25.9
0.35			4.5	244.7	3.7	153.6	3.4	123.7	3.1	100.6	2.6	68.2	2.3	47.6	2.1	41.6	2.0	34.1	34.1
0.40			5.1	312.3	4.2	195.8	3.9	157.6	3.5	128.1	3.0	86.7	2.6	60.5	2.5	52.8	2.3	43.3	43.3
0.45			5.7	387.6	4.7	242.8	4.3	195.3	4.0	158.6	3.4	107.3	2.9	74.9	2.8	65.3	2.5	53.6	53.6
0.50					5.3	294.4	4.8	236.7	4.4	192.2	3.8	130.0	3.2	90.6	3.1	79.0	2.8	64.8	64.8
0.55					5.8	350.7	5.3	281.9	4.9	228.7	4.1	154.6	3.6	107.7	3.4	93.9	3.1	76.9	76.9
0.60							5.8	330.7	5.3	268.3	4.5	181.2	3.9	126.1	3.7	109.9	3.4	90.1	90.1
0.65									5.7	310.8	4.9	209.8	4.2	145.9	4.0	127.2	3.7	104.2	104.2
0.70											5.3	240.3	4.5	167.1	4.3	145.6	4.0	119.2	119.2
0.75											5.7	272.8	4.9	189.6	4.6	165.1	4.2	135.2	135.2
0.80													5.2	213.4	4.9	185.9	4.5	152.2	152.2
0.85													5.5	238.6	5.2	207.7	4.8	170.0	170.0
0.90													5.8	265.0	5.5	230.7	5.1	188.8	188.8
0.95															5.8	254.9	5.4	208.5	208.5
1.0																	5.7	229.2	229.2
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Q = water flow [l/s], v = velocity [m/s], J = pressure loss [mbar/m].

Table Continuous pressure losses for conveyance of water at 10°C (continues).

Pipe Q	20x2		25x2.5 - 26x3		32x3		40x3.5		50x4		63x4.5		75x5		90x7	
	v	J	v	J	v	J	v	J	v	J	v	J	v	J	v	J
0.01	0.0	0.1														
0.02	0.1	0.2	0.1	0.1												
0.03	0.1	0.4	0.1	0.1	0.1	0.0										
0.04	0.2	0.6	0.1	0.2	0.1	0.1										
0.05	0.2	0.8	0.2	0.3	0.1	0.1	0.1	0.0								
0.06	0.3	1.2	0.2	0.4	0.1	0.1	0.1	0.0								
0.07	0.3	1.5	0.2	0.5	0.1	0.2	0.1	0.0	0.1	0.0						
0.08	0.4	1.9	0.3	0.7	0.2	0.2	0.1	0.1	0.1	0.0						
0.09	0.4	2.3	0.3	0.8	0.2	0.2	0.1	0.1	0.1	0.0						
0.10	0.5	2.8	0.3	1.0	0.2	0.3	0.1	0.1	0.1	0.0						
0.15	0.7	5.6	0.5	1.9	0.3	0.6	0.2	0.2	0.1	0.1	0.1	0.0				
0.20	1.0	9.3	0.6	3.2	0.4	0.9	0.2	0.3	0.1	0.1	0.1	0.0	0.1	0.0		
0.25	1.2	13.8	0.8	4.7	0.5	1.4	0.3	0.4	0.2	0.1	0.1	0.0	0.1	0.0	0.1	0.0
0.30	1.5	19.0	1.0	6.5	0.6	1.9	0.4	0.6	0.2	0.2	0.1	0.1	0.1	0.0	0.1	0.0
0.35	1.7	25.0	1.1	8.6	0.7	2.4	0.4	0.8	0.3	0.2	0.2	0.1	0.1	0.0	0.1	0.0
0.40	2.0	31.7	1.3	10.8	0.8	3.1	0.5	1.0	0.3	0.3	0.2	0.1	0.1	0.0	0.1	0.0
0.45	2.2	39.2	1.4	13.4	0.8	3.8	0.5	1.2	0.3	0.4	0.2	0.1	0.1	0.0	0.1	0.0
0.50	2.5	47.4	1.6	16.1	0.9	4.6	0.6	1.5	0.4	0.5	0.2	0.1	0.2	0.1	0.1	0.0
0.55	2.7	56.2	1.8	19.1	1.0	5.4	0.6	1.7	0.4	0.5	0.2	0.2	0.2	0.1	0.1	0.0
0.60	3.0	65.8	1.9	22.3	1.1	6.3	0.7	2.0	0.4	0.6	0.3	0.2	0.2	0.1	0.1	0.0
0.65	3.2	76.1	2.1	25.8	1.2	7.3	0.8	2.3	0.5	0.7	0.3	0.2	0.2	0.1	0.1	0.0
0.70	3.5	87.0	2.2	29.5	1.3	8.3	0.8	2.6	0.5	0.8	0.3	0.3	0.2	0.1	0.2	0.0
0.75	3.7	98.7	2.4	33.4	1.4	9.4	0.9	3.0	0.5	0.9	0.3	0.3	0.2	0.1	0.2	0.1
0.80	4.0	111.0	2.5	37.5	1.5	10.5	0.9	3.4	0.6	1.1	0.3	0.3	0.2	0.1	0.2	0.1
0.85	4.2	124.0	2.7	41.8	1.6	11.8	1.0	3.7	0.6	1.2	0.4	0.4	0.3	0.1	0.2	0.1
0.90	4.5	137.6	2.9	46.4	1.7	13.0	1.1	4.1	0.6	1.3	0.4	0.4	0.3	0.2	0.2	0.1
0.95	4.7	151.9	3.0	51.1	1.8	14.3	1.1	4.6	0.7	1.4	0.4	0.4	0.3	0.2	0.2	0.1
1.0	5.0	166.9	3.2	56.1	1.9	15.7	1.2	5.0	0.7	1.6	0.4	0.5	0.3	0.2	0.2	0.1
1.1	5.5	198.9	3.5	66.7	2.1	18.7	1.3	5.9	0.8	1.9	0.5	0.6	0.3	0.2	0.2	0.1
1.2	6.0	233.5	3.8	78.2	2.3	21.8	1.4	6.9	0.9	2.2	0.5	0.7	0.4	0.3	0.3	0.1
1.3			4.1	90.5	2.4	25.2	1.5	8.0	0.9	2.5	0.6	0.8	0.4	0.3	0.3	0.1
1.4			4.5	103.7	2.6	28.9	1.6	9.1	1.0	2.9	0.6	0.9	0.4	0.4	0.3	0.2
1.5			4.8	117.7	2.8	32.7	1.8	10.3	1.1	3.2	0.7	1.0	0.5	0.4	0.3	0.2
1.6			5.1	132.5	3.0	36.8	1.9	11.6	1.2	3.6	0.7	1.1	0.5	0.4	0.4	0.2
1.7			5.4	148.1	3.2	41.1	2.0	12.9	1.2	4.0	0.7	1.2	0.5	0.5	0.4	0.2
1.8			5.7	164.6	3.4	45.6	2.1	14.3	1.3	4.5	0.8	1.3	0.5	0.6	0.4	0.3
1.9					3.6	50.3	2.2	15.8	1.4	4.9	0.8	1.5	0.6	0.6	0.4	0.3
2.0					3.8	55.2	2.3	17.3	1.4	5.4	0.9	1.6	0.6	0.7	0.4	0.3
2.1					4.0	60.4	2.5	18.9	1.5	5.9	0.9	1.8	0.6	0.7	0.5	0.3
2.2					4.1	65.8	2.6	20.6	1.6	6.4	1.0	1.9	0.7	0.8	0.5	0.4
2.3					4.3	71.3	2.7	22.3	1.7	6.9	1.0	2.1	0.7	0.9	0.5	0.4
2.4					4.5	77.1	2.8	24.1	1.7	7.5	1.0	2.2	0.7	0.9	0.5	0.4
2.5					4.7	83.1	2.9	26.0	1.8	8.1	1.1	2.4	0.8	1.0	0.6	0.5
2.6					4.9	89.4	3.0	27.9	1.9	8.7	1.1	2.6	0.8	1.1	0.6	0.5
2.7					5.1	95.8	3.2	29.9	1.9	9.3	1.2	2.8	0.8	1.1	0.6	0.5
2.8					5.3	102.4	3.3	31.9	2.0	9.9	1.2	2.9	0.8	1.2	0.6	0.6
2.9					5.5	109.3	3.4	34.0	2.1	10.6	1.3	3.1	0.9	1.3	0.6	0.6
3.0					5.7	116.3	3.5	36.2	2.2	11.2	1.3	3.3	0.9	1.4	0.7	0.6
3.5							4.1	48.0	2.5	14.8	1.5	4.4	1.1	1.8	0.8	0.8
4.0							4.7	61.4	2.9	18.9	1.7	5.6	1.2	2.3	0.9	1.1
4.5							5.3	76.3	3.2	23.5	2.0	6.9	1.4	2.8	1.0	1.3
5.0							5.8	92.7	3.6	28.4	2.2	8.4	1.5	3.4	1.1	1.6
5.5									4.0	33.9	2.4	10.0	1.7	4.1	1.2	1.9
6									4.3	39.7	2.6	11.7	1.8	4.8	1.3	2.2
7									5.1	52.8	3.1	15.5	2.1	6.3	1.5	2.9
8									5.8	67.6	3.5	19.7	2.4	8.0	1.8	3.8
9											3.9	24.5	2.7	9.9	2.0	4.7
10											4.4	29.8	3.0	12.0	2.2	5.6
11											4.8	35.5	3.3	14.3	2.4	6.7
12											5.2	41.7	3.6	16.8	2.6	7.9
13											5.7	48.4	3.9	19.5	2.9	9.1
14													4.2	22.3	3.1	10.4
15													4.5	25.4	3.3	11.8
16													4.8	28.6	3.5	13.3
18													5.4	35.6	4.0	16.5
20															4.4	20.1
22															4.8	23.9
24															5.3	28.1
26															5.7	32.6

Q = water flow [l/s], v = velocity [m/s], J = pressure loss [mbar/m].

Table Continuous pressure losses for conveyance of water at 60°C.

Pipe Q	12x2		14x2		15x2		16x2.25		16x2		17x2		18x2		20x2.8		20x2.5	
	v	J	v	J	v	J	v	J	v	J	v	J	v	J	v	J	v	J
0.01	0.2	1.1	0.1	0.4	0.1	0.2	0.1	0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
0.02	0.4	3.5	0.3	1.2	0.2	0.8	0.2	0.6	0.2	0.5	0.2	0.3	0.1	0.2	0.1	0.2	0.1	0.2
0.03	0.6	7.2	0.4	2.5	0.3	1.6	0.3	1.3	0.3	1.0	0.2	0.7	0.2	0.5	0.2	0.4	0.2	0.4
0.04	0.8	11.9	0.5	4.1	0.4	2.6	0.4	2.1	0.4	1.7	0.3	1.2	0.3	0.8	0.2	0.7	0.2	0.6
0.05	1.0	17.7	0.6	6.0	0.5	3.8	0.5	3.1	0.4	2.5	0.4	1.7	0.3	1.2	0.3	1.1	0.3	0.9
0.06	1.2	24.6	0.8	8.4	0.6	5.3	0.6	4.3	0.5	3.5	0.5	2.4	0.4	1.7	0.4	1.4	0.3	1.2
0.07	1.4	32.5	0.9	11.0	0.7	6.9	0.7	5.6	0.6	4.6	0.5	3.1	0.5	2.2	0.4	1.9	0.4	1.6
0.08	1.6	41.4	1.0	14.0	0.8	8.8	0.8	7.1	0.7	5.8	0.6	3.9	0.5	2.8	0.5	2.4	0.5	2.0
0.09	1.8	51.4	1.1	17.3	0.9	10.9	0.9	8.8	0.8	7.1	0.7	4.9	0.6	3.4	0.6	3.0	0.5	2.4
0.10	2.0	62.3	1.3	20.9	1.1	13.2	1.0	10.6	0.9	8.6	0.8	5.9	0.6	4.1	0.6	3.6	0.6	2.9
0.15	3.0	131.5	1.9	43.7	1.6	27.4	1.4	22.1	1.3	17.9	1.1	12.1	1.0	8.5	0.9	7.4	0.8	6.1
0.20	4.0	225.0	2.5	74.3	2.1	46.4	1.9	37.3	1.8	30.3	1.5	20.5	1.3	14.3	1.2	12.4	1.1	10.2
0.25	5.0	342.3	3.2	112.4	2.6	70.1	2.4	56.3	2.2	45.6	1.9	30.8	1.6	21.4	1.5	18.6	1.4	15.3
0.30	6.0	483.4	3.8	157.9	3.2	98.3	2.9	78.9	2.7	63.9	2.3	43.0	1.9	29.9	1.8	26.0	1.7	21.3
0.35			4.5	211.0	3.7	131.1	3.4	105.1	3.1	85.1	2.6	57.2	2.3	39.7	2.1	34.6	2.0	28.3
0.40			5.1	271.4	4.2	168.4	3.9	134.9	3.5	109.1	3.0	73.3	2.6	50.8	2.5	44.2	2.3	36.2
0.45			5.7	339.2	4.7	210.2	4.3	168.3	4.0	136.1	3.4	91.4	2.9	63.2	2.8	55.0	2.5	45.0
0.50					5.3	256.5	4.8	205.3	4.4	165.9	3.8	111.3	3.2	77.0	3.1	66.9	2.8	54.7
0.55					5.8	307.3	5.3	245.8	4.9	198.6	4.1	133.1	3.6	92.0	3.4	80.0	3.1	65.3
0.60							5.8	289.9	5.3	234.1	4.5	156.7	3.9	108.3	3.7	94.1	3.4	76.8
0.65									5.7	272.4	4.9	182.3	4.2	125.8	4.0	109.3	3.7	89.2
0.70											5.3	209.7	4.5	144.7	4.3	125.7	4.0	102.5
0.75											5.7	239.0	4.9	164.8	4.6	143.1	4.2	116.7
0.80													5.2	186.2	4.9	161.7	4.5	131.8
0.85													5.5	208.9	5.2	181.4	4.8	147.8
0.90													5.8	232.8	5.5	202.1	5.1	164.7
0.95															5.8	224.0	5.4	182.4
1.0																	5.7	201.1
1.1																		
1.2																		
1.3																		
1.4																		
1.5																		
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Q = water flow [l/s], v = velocity [m/s], J = pressure loss [mbar/m].

Table Continuous pressure losses for conveyance of water at 60°C (continues).

Pipe Q	20x2		25x2.5 - 26x3		32x3		40x3.5		50x4		63x4.5		75x5		90x7	
	v	J	v	J	v	J	v	J	v	J	v	J	v	J	v	J
0.01	0.0	0.0														
0.02	0.1	0.1	0.1	0.0												
0.03	0.1	0.3	0.1	0.1	0.1											
0.04	0.2	0.4	0.1	0.2	0.1											
0.05	0.2	0.6	0.2	0.2	0.1	0.1	0.1	0.0								
0.06	0.3	0.9	0.2	0.3	0.1	0.1	0.1	0.0								
0.07	0.3	1.1	0.2	0.4	0.1	0.1	0.1	0.0	0.1	0.0						
0.08	0.4	1.5	0.3	0.5	0.2	0.1	0.1	0.0	0.1	0.0						
0.09	0.4	1.8	0.3	0.6	0.2	0.2	0.1	0.1	0.1	0.0						
0.10	0.5	2.2	0.3	0.7	0.2	0.2	0.1	0.1	0.1	0.0						
0.15	0.7	4.4	0.5	1.5	0.3	0.4	0.2	0.1	0.1	0.0	0.1	0.0				
0.20	1.0	7.4	0.6	2.5	0.4	0.7	0.2	0.2	0.1	0.1	0.1	0.0	0.1	0.0		
0.25	1.2	11.1	0.8	3.8	0.5	1.1	0.3	0.3	0.2	0.1	0.1	0.0	0.1	0.0	0.1	0.0
0.30	1.5	15.5	1.0	5.2	0.6	1.5	0.4	0.5	0.2	0.1	0.1	0.0	0.1	0.0	0.1	0.0
0.35	1.7	20.6	1.1	6.9	0.7	1.9	0.4	0.6	0.3	0.2	0.2	0.1	0.1	0.0	0.1	0.0
0.40	2.0	26.3	1.3	8.8	0.8	2.5	0.5	0.8	0.3	0.2	0.2	0.1	0.1	0.0	0.1	0.0
0.45	2.2	32.7	1.4	10.9	0.8	3.1	0.5	1.0	0.3	0.3	0.2	0.1	0.1	0.0	0.1	0.0
0.50	2.5	39.7	1.6	13.3	0.9	3.7	0.6	1.2	0.4	0.4	0.2	0.1	0.2	0.0	0.1	0.0
0.55	2.7	47.4	1.8	15.8	1.0	4.4	0.6	1.4	0.4	0.4	0.2	0.1	0.2	0.1	0.1	0.0
0.60	3.0	55.8	1.9	18.6	1.1	5.1	0.7	1.6	0.4	0.5	0.3	0.2	0.2	0.1	0.1	0.0
0.65	3.2	64.7	2.1	21.5	1.2	6.0	0.8	1.9	0.5	0.6	0.3	0.2	0.2	0.1	0.1	0.0
0.70	3.5	74.4	2.2	24.7	1.3	6.8	0.8	2.1	0.5	0.7	0.3	0.2	0.2	0.1	0.2	0.0
0.75	3.7	84.6	2.4	28.0	1.4	7.7	0.9	2.4	0.5	0.8	0.3	0.2	0.2	0.1	0.2	0.0
0.80	4.0	95.5	2.5	31.6	1.5	8.7	0.9	2.7	0.6	0.8	0.3	0.3	0.2	0.1	0.2	0.0
0.85	4.2	107.1	2.7	35.3	1.6	9.7	1.0	3.0	0.6	0.9	0.4	0.3	0.3	0.1	0.2	0.1
0.90	4.5	119.2	2.9	39.3	1.7	10.8	1.1	3.4	0.6	1.0	0.4	0.3	0.3	0.1	0.2	0.1
0.95	4.7	132.0	3.0	43.5	1.8	11.9	1.1	3.7	0.7	1.2	0.4	0.3	0.3	0.1	0.2	0.1
1.0	5.0	145.5	3.2	47.8	1.9	13.1	1.2	4.1	0.7	1.3	0.4	0.4	0.3	0.2	0.2	0.1
1.1	5.5	174.3	3.5	57.2	2.1	15.6	1.3	4.9	0.8	1.5	0.5	0.4	0.3	0.2	0.2	0.1
1.2	6.0	205.6	3.8	67.3	2.3	18.4	1.4	5.7	0.9	1.8	0.5	0.5	0.4	0.2	0.3	0.1
1.3			4.1	78.3	2.4	21.3	1.5	6.6	0.9	2.0	0.6	0.6	0.4	0.2	0.3	0.1
1.4			4.5	90.0	2.6	24.5	1.6	7.6	1.0	2.3	0.6	0.7	0.4	0.3	0.3	0.1
1.5			4.8	102.5	2.8	27.8	1.8	8.6	1.1	2.6	0.7	0.8	0.5	0.3	0.3	0.2
1.6			5.1	115.8	3.0	31.4	1.9	9.7	1.2	3.0	0.7	0.9	0.5	0.4	0.4	0.2
1.7			5.4	129.9	3.2	35.1	2.0	10.8	1.2	3.3	0.7	1.0	0.5	0.4	0.4	0.2
1.8			5.7	144.8	3.4	39.1	2.1	12.0	1.3	3.7	0.8	1.1	0.5	0.4	0.4	0.2
1.9					3.6	43.3	2.2	13.3	1.4	4.1	0.8	1.2	0.6	0.5	0.4	0.2
2.0					3.8	47.6	2.3	14.6	1.4	4.5	0.9	1.3	0.6	0.5	0.4	0.3
2.1					4.0	52.2	2.5	16.0	1.5	4.9	0.9	1.4	0.6	0.6	0.5	0.3
2.2					4.1	57.0	2.6	17.5	1.6	5.3	1.0	1.6	0.7	0.6	0.5	0.3
2.3					4.3	62.0	2.7	19.0	1.7	5.8	1.0	1.7	0.7	0.7	0.5	0.3
2.4					4.5	67.2	2.8	20.5	1.7	6.3	1.0	1.8	0.7	0.7	0.5	0.4
2.5					4.7	72.5	2.9	22.2	1.8	6.8	1.1	2.0	0.8	0.8	0.6	0.4
2.6					4.9	78.1	3.0	23.9	1.9	7.3	1.1	2.1	0.8	0.9	0.6	0.4
2.7					5.1	83.9	3.2	25.6	1.9	7.8	1.2	2.3	0.8	0.9	0.6	0.4
2.8					5.3	89.9	3.3	27.4	2.0	8.3	1.2	2.4	0.8	1.0	0.6	0.5
2.9					5.5	96.1	3.4	29.3	2.1	8.9	1.3	2.6	0.9	1.1	0.6	0.5
3.0					5.7	102.5	3.5	31.2	2.2	9.5	1.3	2.8	0.9	1.1	0.7	0.5
3.5							4.1	41.7	2.5	12.6	1.5	3.7	1.1	1.5	0.8	0.7
4.0							4.7	53.6	2.9	16.2	1.7	4.7	1.2	1.9	0.9	0.9
4.5							5.3	67.1	3.2	20.2	2.0	5.8	1.4	2.4	1.0	1.1
5.0							5.8	81.9	3.6	24.6	2.2	7.1	1.5	2.9	1.1	1.3
5.5									4.0	29.4	2.4	8.5	1.7	3.4	1.2	1.6
6									4.3	34.7	2.6	10.0	1.8	4.0	1.3	1.9
7									5.1	46.4	3.1	13.3	2.1	5.3	1.5	2.5
8									5.8	59.8	3.5	17.1	2.4	6.8	1.8	3.2
9											3.9	21.3	2.7	8.5	2.0	3.9
10											4.4	26.0	3.0	10.4	2.2	4.8
11											4.8	31.2	3.3	12.4	2.4	5.7
12											5.2	36.8	3.6	14.6	2.6	6.7
13											5.7	42.8	3.9	17.0	2.9	7.8
14													4.2	19.5	3.1	9.0
15													4.5	22.3	3.3	10.2
16													4.8	25.2	3.5	11.6
18													5.4	31.5	4.0	14.4
20															4.4	17.6
22															4.8	21.1
24															5.3	24.9
26															5.7	29.0

Q = water flow [l/s], v = velocity [m/s], J = pressure loss [mbar/m].

Table Continuous pressure losses for conveyance of water a 80°C.

Pipe Q	12x2		14x2		15x2		16x2.25		16x2		17x2		18x2		20x2.8		20x2.5	
	v	J	v	J	v	J	v	J	v	J	v	J	v	J	v	J	v	J
0.01	0.2	1.0	0.1	0.3	0.1	0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
0.02	0.4	3.3	0.3	1.1	0.2	0.7	0.2	0.6	0.2	0.5	0.2	0.3	0.1	0.2	0.1	0.2	0.1	0.2
0.03	0.6	6.7	0.4	2.3	0.3	1.5	0.3	1.2	0.3	1.0	0.2	0.7	0.2	0.5	0.2	0.4	0.2	0.3
0.04	0.8	11.2	0.5	3.8	0.4	2.4	0.4	2.0	0.4	1.6	0.3	1.1	0.3	0.8	0.2	0.7	0.2	0.5
0.05	1.0	16.8	0.6	5.7	0.5	3.6	0.5	2.9	0.4	2.4	0.4	1.6	0.3	1.1	0.3	1.0	0.3	0.8
0.06	1.2	23.4	0.8	7.9	0.6	5.0	0.6	4.0	0.5	3.3	0.5	2.2	0.4	1.6	0.4	1.4	0.3	1.1
0.07	1.4	31.0	0.9	10.4	0.7	6.6	0.7	5.3	0.6	4.3	0.5	2.9	0.5	2.0	0.4	1.8	0.4	1.5
0.08	1.6	39.5	1.0	13.3	0.8	8.3	0.8	6.7	0.7	5.5	0.6	3.7	0.5	2.6	0.5	2.3	0.5	1.9
0.09	1.8	49.1	1.1	16.4	0.9	10.3	0.9	8.3	0.8	6.8	0.7	4.6	0.6	3.2	0.6	2.8	0.5	2.3
0.10	2.0	59.6	1.3	19.9	1.1	12.5	1.0	10.0	0.9	8.2	0.8	5.5	0.6	3.9	0.6	3.4	0.6	2.8
0.15	3.0	126.8	1.9	41.9	1.6	26.2	1.4	21.0	1.3	17.1	1.1	11.5	1.0	8.0	0.9	7.0	0.8	5.7
0.20	4.0	217.9	2.5	71.4	2.1	44.5	1.9	35.7	1.8	29.0	1.5	19.5	1.3	13.6	1.2	11.8	1.1	9.7
0.25	5.0	332.7	3.2	108.5	2.6	67.4	2.4	54.1	2.2	43.8	1.9	29.5	1.6	20.5	1.5	17.8	1.4	14.6
0.30	6.0	471.2	3.8	152.9	3.2	94.9	2.9	76.0	2.7	61.5	2.3	41.3	1.9	28.7	1.8	24.9	1.7	20.4
0.35			4.5	204.8	3.7	126.9	3.4	101.6	3.1	82.1	2.6	55.1	2.3	38.1	2.1	33.2	2.0	27.1
0.40			5.1	264.0	4.2	163.3	3.9	130.7	3.5	105.6	3.0	70.8	2.6	48.9	2.5	42.5	2.3	34.8
0.45			5.7	330.5	4.7	204.3	4.3	163.3	4.0	131.9	3.4	88.3	2.9	61.0	2.8	53.0	2.5	43.3
0.50					5.3	249.7	4.8	199.5	4.4	161.0	3.8	107.8	3.2	74.4	3.1	64.6	2.8	52.7
0.55					5.8	299.5	5.3	239.3	4.9	193.0	4.1	129.1	3.6	89.0	3.4	77.3	3.1	63.1
0.60							5.8	282.5	5.3	227.9	4.5	152.2	3.9	104.9	3.7	91.1	3.4	74.3
0.65									5.7	265.5	4.9	177.3	4.2	122.1	4.0	106.0	3.7	86.4
0.70											5.3	204.2	4.5	140.6	4.3	122.0	4.0	99.4
0.75											5.7	232.9	4.9	160.3	4.6	139.1	4.2	113.3
0.80													5.2	181.3	4.9	157.3	4.5	128.1
0.85													5.5	203.5	5.2	176.5	4.8	143.7
0.90													5.8	227.0	5.5	196.9	5.1	160.3
0.95															5.8	218.4	5.4	177.7
1.0																	5.7	196.0
1.1																		
1.2																		
1.3																		
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1.5																		
1.6																		
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Q = water flow [l/s], v = velocity [m/s], J = pressure loss [mbar/m].

Table Continuous pressure losses for conveyance of water at 80°C (continues).

Pipe Q	20x2		25x2.5 - 26x3		32x3		40x3.5		50x4		63x4.5		75x5		90x7	
	v	J	v	J	v	J	v	J	v	J	v	J	v	J	v	J
0.01																
0.02	0.1	0.1	0.1	0.0												
0.03	0.1	0.2	0.1	0.1	0.1	0.0										
0.04	0.2	0.4	0.1	0.1	0.1	0.0										
0.05	0.2	0.6	0.2	0.2	0.1	0.1	0.1	0.0								
0.06	0.3	0.8	0.2	0.3	0.1	0.1	0.1	0.0								
0.07	0.3	1.1	0.2	0.4	0.1	0.1	0.1	0.0	0.1	0.0						
0.08	0.4	1.4	0.3	0.5	0.2	0.1	0.1	0.0	0.1	0.0						
0.09	0.4	1.7	0.3	0.6	0.2	0.2	0.1	0.1	0.1	0.0						
0.10	0.5	2.0	0.3	0.7	0.2	0.2	0.1	0.1	0.1	0.0						
0.15	0.7	4.2	0.5	1.4	0.3	0.4	0.2	0.1	0.1	0.0	0.1	0.0				
0.20	1.0	7.1	0.6	2.4	0.4	0.7	0.2	0.2	0.1	0.1	0.1	0.0	0.1	0.0		
0.25	1.2	10.6	0.8	3.6	0.5	1.0	0.3	0.3	0.2	0.1	0.1	0.0	0.1	0.0	0.1	0.0
0.30	1.5	14.8	1.0	5.0	0.6	1.4	0.4	0.4	0.2	0.1	0.1	0.0	0.1	0.0	0.1	0.0
0.35	1.7	19.7	1.1	6.6	0.7	1.8	0.4	0.6	0.3	0.2	0.2	0.1	0.1	0.0	0.1	0.0
0.40	2.0	25.3	1.3	8.4	0.8	2.3	0.5	0.7	0.3	0.2	0.2	0.1	0.1	0.0	0.1	0.0
0.45	2.2	31.4	1.4	10.5	0.8	2.9	0.5	0.9	0.3	0.3	0.2	0.1	0.1	0.0	0.1	0.0
0.50	2.5	38.3	1.6	12.7	0.9	3.5	0.6	1.1	0.4	0.3	0.2	0.1	0.2	0.0	0.1	0.0
0.55	2.7	45.7	1.8	15.1	1.0	4.2	0.6	1.3	0.4	0.4	0.2	0.1	0.2	0.1	0.1	0.0
0.60	3.0	53.8	1.9	17.8	1.1	4.9	0.7	1.5	0.4	0.5	0.3	0.1	0.2	0.1	0.1	0.0
0.65	3.2	62.6	2.1	20.7	1.2	5.7	0.8	1.8	0.5	0.6	0.3	0.2	0.2	0.1	0.1	0.0
0.70	3.5	71.9	2.2	23.7	1.3	6.5	0.8	2.0	0.5	0.6	0.3	0.2	0.2	0.1	0.2	0.0
0.75	3.7	82.0	2.4	27.0	1.4	7.4	0.9	2.3	0.5	0.7	0.3	0.2	0.2	0.1	0.2	0.0
0.80	4.0	92.6	2.5	30.4	1.5	8.3	0.9	2.6	0.6	0.8	0.3	0.2	0.2	0.1	0.2	0.0
0.85	4.2	103.9	2.7	34.1	1.6	9.3	1.0	2.9	0.6	0.9	0.4	0.3	0.3	0.1	0.2	0.1
0.90	4.5	115.8	2.9	37.9	1.7	10.4	1.1	3.2	0.6	1.0	0.4	0.3	0.3	0.1	0.2	0.1
0.95	4.7	128.4	3.0	42.0	1.8	11.4	1.1	3.6	0.7	1.1	0.4	0.3	0.3	0.1	0.2	0.1
1.0	5.0	141.5	3.2	46.2	1.9	12.6	1.2	3.9	0.7	1.2	0.4	0.4	0.3	0.1	0.2	0.1
1.1	5.5	169.8	3.5	55.4	2.1	15.0	1.3	4.7	0.8	1.4	0.5	0.4	0.3	0.2	0.2	0.1
1.2	6.0	200.5	3.8	65.3	2.3	17.7	1.4	5.5	0.9	1.7	0.5	0.5	0.4	0.2	0.3	0.1
1.3			4.1	75.9	2.4	20.5	1.5	6.3	0.9	1.9	0.6	0.6	0.4	0.2	0.3	0.1
1.4			4.5	87.4	2.6	23.6	1.6	7.3	1.0	2.2	0.6	0.7	0.4	0.3	0.3	0.1
1.5			4.8	99.7	2.8	26.8	1.8	8.2	1.1	2.5	0.7	0.7	0.5	0.3	0.3	0.1
1.6			5.1	112.8	3.0	30.3	1.9	9.3	1.2	2.8	0.7	0.8	0.5	0.3	0.4	0.2
1.7			5.4	126.6	3.2	34.0	2.0	10.4	1.2	3.2	0.7	0.9	0.5	0.4	0.4	0.2
1.8			5.7	141.2	3.4	37.8	2.1	11.6	1.3	3.5	0.8	1.0	0.5	0.4	0.4	0.2
1.9					3.6	41.9	2.2	12.8	1.4	3.9	0.8	1.1	0.6	0.5	0.4	0.2
2.0					3.8	46.2	2.3	14.1	1.4	4.3	0.9	1.3	0.6	0.5	0.4	0.2
2.1					4.0	50.7	2.5	15.4	1.5	4.7	0.9	1.4	0.6	0.6	0.5	0.3
2.2					4.1	55.3	2.6	16.9	1.6	5.1	1.0	1.5	0.7	0.6	0.5	0.3
2.3					4.3	60.2	2.7	18.3	1.7	5.6	1.0	1.6	0.7	0.7	0.5	0.3
2.4					4.5	65.3	2.8	19.8	1.7	6.0	1.0	1.8	0.7	0.7	0.5	0.3
2.5					4.7	70.6	2.9	21.4	1.8	6.5	1.1	1.9	0.8	0.8	0.6	0.4
2.6					4.9	76.1	3.0	23.1	1.9	7.0	1.1	2.0	0.8	0.8	0.6	0.4
2.7					5.1	81.7	3.2	24.8	1.9	7.5	1.2	2.2	0.8	0.9	0.6	0.4
2.8					5.3	87.6	3.3	26.5	2.0	8.0	1.2	2.3	0.8	0.9	0.6	0.4
2.9					5.5	93.7	3.4	28.4	2.1	8.6	1.3	2.5	0.9	1.0	0.6	0.5
3.0					5.7	100.0	3.5	30.2	2.2	9.1	1.3	2.6	0.9	1.1	0.7	0.5
3.5							4.1	40.5	2.5	12.2	1.5	3.5	1.1	1.4	0.8	0.7
4.0							4.7	52.2	2.9	15.6	1.7	4.5	1.2	1.8	0.9	0.8
4.5							5.3	65.4	3.2	19.5	2.0	5.6	1.4	2.3	1.0	1.1
5.0							5.8	80.0	3.6	23.8	2.2	6.8	1.5	2.7	1.1	1.3
5.5									4.0	28.6	2.4	8.2	1.7	3.3	1.2	1.5
6									4.3	33.7	2.6	9.6	1.8	3.9	1.3	1.8
7									5.1	45.2	3.1	12.9	2.1	5.1	1.5	2.4
8									5.8	58.4	3.5	16.6	2.4	6.6	1.8	3.0
9											3.9	20.7	2.7	8.2	2.0	3.8
10											4.4	25.3	3.0	10.0	2.2	4.6
11											4.8	30.4	3.3	12.0	2.4	5.5
12											5.2	35.9	3.6	14.2	2.6	6.5
13											5.7	41.8	3.9	16.5	2.9	7.6
14													4.2	19.0	3.1	8.7
15													4.5	21.7	3.3	9.9
16													4.8	24.5	3.5	11.2
18													5.4	30.7	4.0	14.0
20															4.4	17.1
22															4.8	20.6
24															5.3	24.3
26															5.7	28.3

Q = water flow [l/s], v = velocity [m/s], J = pressure loss [mbar/m].

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