HENCO **TECHNICAL MANUAL 2006**

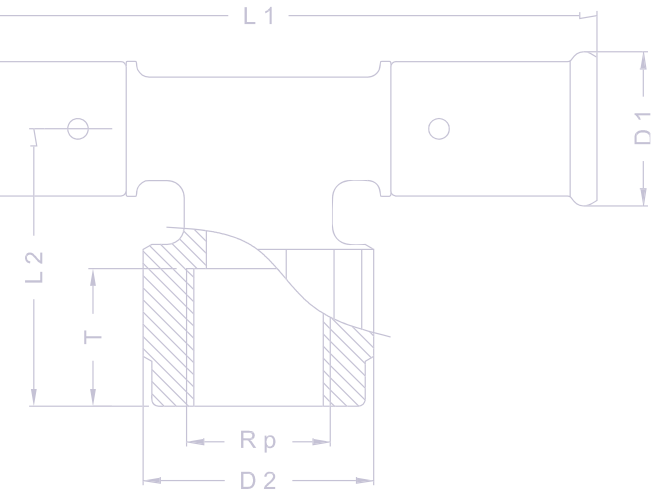
RADIATOR

SANITARY

GAS

CERTIFIED QUALITY SYSTEM ISO 9001

PE-Xc/AL/PE-Xc 100% QUALITY



HENCO

MADE IN BELGIUM

Your Connection to Perfection

UNDERFLOOR HEATING

Floor heating: see manual

Quality is the norm. Henco Industries produces and distributes a complete and coordinated range of top quality products that stand out by their constant technological innovation. All system components exude the reliability that Henco is so well known for. The heart of the comprehensive range is without doubt the patented multilayer pipe.

Under the motto “only the best is good enough”, the Henco multilayer pipe was conceived and designed to ensure it satisfies the most demanding and diverse requirements for use. The result is again the most innovative, multifunctional and most reliable pipe on the international market.

Henco Industries develops and produces its own synthetic fittings for these quality pipes. The synthetic fittings are made of polyvinylidene fluoride (PVDF) and are provided with elastic O-rings and stainless steel sleeves.
Pressing allows the pipe and couplings to form the perfect whole.

Besides press fittings in synthetic material and brass, Henco also has screw fittings, manifolds, manifold cabinets and tools in its range. All these top quality products are perfectly matched to each other. In conclusion, Henco offers you everything from under one roof.

The high quality level and great reliability of the pipe system is confirmed on an international scale by numerous test certificates.

This handy reference book offers you a complete summary of the Henco products, while mentioning their specific technical characteristics. It has been compiled with the greatest of care, and structured as clearly as possible so you can always quickly and efficiently find what you are looking for.

This book will remain your loyal partner while you are working with our products. Henco thanks you for your interest, and wishes you every success!

PIPES

1.1 Henco multilayer pipe

1.1.1 A pipe for all applications

	**Drinking water**	As drinking water pipes for both cold and hot water.
	**Heating and cooling**	As a heating pipe within the specified load values (10 bar/95°C).
	**Rainwater**	As a rainwater pipe inside buildings within the specified load values (10 bar/95°C).
	**Gas**	As a gas pipe in countries where the testing of the system has taken place and where a certificate is available.
	**Compressed air**	As compressed air piping in oil-free installations (with activated oil filter).
	**Heating oil**	As heating oil piping within the specified load values (10 bar/95°C).
	**Other applications**	On request to Henco.

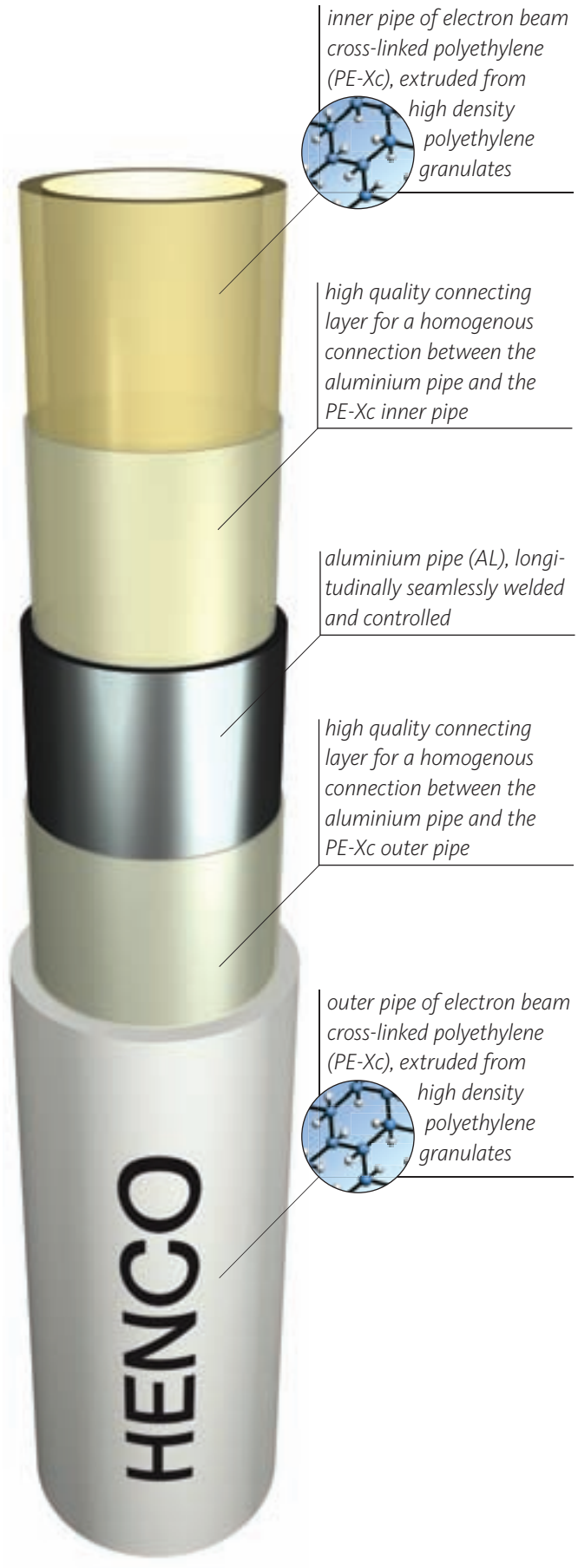
PE-Xc /AL / PE-Xc
100% QUALITY

1.1.2 Composition of the Henco multilayer pipe: PE-Xc/AL/PE-Xc

The Henco multilayer pipe consists of a continuous butt welded aluminium pipe provided with an inner and outer layer of electron beam cross-linked polyethylene.
The different layers are bonded to each by a high quality connecting layer. The result is the Henco multilayer pipe: it combines all the advantages of synthetic materials and metal pipes.

The inner and outer pipe are made of high density polyethylene (HDPE) granulates cross-linked by electron beams. Cross-linking multiplies the natural qualities of the polyethylene many times. This results in aspects such as the improved pressure and temperature resistance of the pipe.
The pipe meets the requirements of the strictest of standards for drinking water installations, and is even resistant to aggressive substances.

The aluminium pipe guarantees the oxygen-tightness and shape retaining properties of the pipe. The longitudinal butt welding of the aluminium pipe means the aluminium keeps the same thickness along its whole length. Consequently, the cross-linked outer layer applied with the connecting layer on the aluminium pipe will also have the same thickness. This also offers advantages when pressing, as the press loads are perfectly distributed. Depending on the diameter of the pipe, the thickness of the aluminium layer is calculated so the pipe always retains optimal flexibility and pressure-resistance.

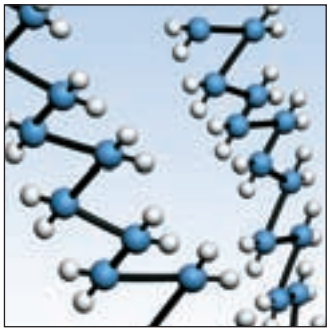


PE-Xc /AL / PE-Xc
100% QUALITY

1.1.3 Inner and outer pipe of PE-Xc, quality assured

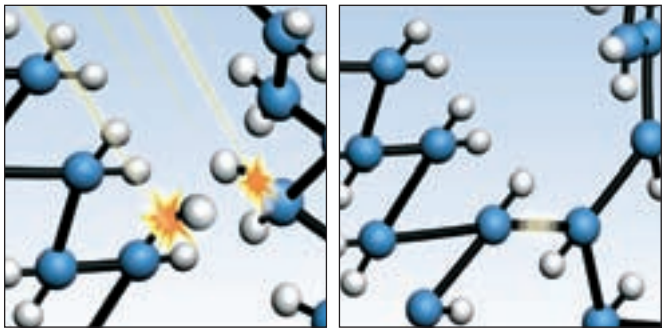
Henco produces multilayer pipes with both the inner and outer pipe consisting of PE-Xc, electron beam cross-linked polyethylene.

PE stands for **polyethylene**
X stands for **cross-linking**
c stands for **electron beam cross-linking**, the process in which the polyethylene is cross-linked



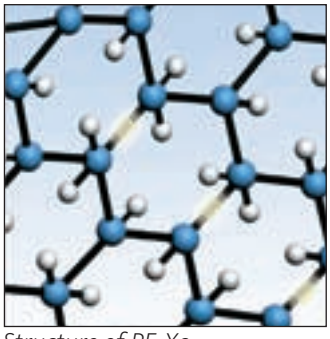
Structure of high density polyethylene

Polyethylene is a plastic that consists of different chains of molecules. These chains are not directly connected to each other. The basic structure is kept together by weak mutual forces between the molecules. When heated the chains move more vigorously and further from each other. As a result, the material becomes softer, more elastic and less pressure-resistant.
Ultimately, it becomes less suitable for sanitary applications or heating.



Cross-linking process by means of electron beams

Exposing the multilayer pipe to intense electron beams causes cross **connection**s between the different molecule chains of the plastic. The electrons cause the oxygen atoms to split from the different polyethylene chains. The carbon atoms are then allowed to join and form a strong cross-linked structure.



Structure of PE-Xc

The cross connections mean the movement of the chains with respect to each other is kept to a minimum. When heat or another form of energy is applied, the strong structure of the pipe will not be distorted. Cross-linked polyethylene displays optimal behaviour under continuous loads due to pressure or temperature. Cross-linking ensures **enormous durability**.

1 PIPES

Cross-linking by way of electron beams is the best and purest way to cross-link polyethylene.

Polyethylene can be cross-linked in the following ways:

a. **PE-Xa**: the so-called Engel process, where the polyethylene is mixed with a high concentration of organic peroxide. The peroxide cause connections to take place between the polyethylene chains. A chemical method.

b. **PE-Xb**: cross-linking originates by the addition of silane to the polyethylene, followed by a water treatment. A chemical method.

c. **PE-Xc**: as distinct from the two last methods, cross-linking takes place during a second process when the pipe is exposed to intense electron beams. The beams excite the polyethylene molecules so much that they cross-link. A physical method.

The German standard DIN 16892 determines the minimum degree of cross-linking for each of the methods.

Cross-linking method		Procedure	
Description	Minimum cross-linking levels according to standard DIN 16892	Physical	Chemical
PE-Xa	70 %		peroxide
PE-Xb	65 %		silane
PE-Xc	60 %	electron beams	

We therefore conclude that a PE-Xa pipe must be 70% cross-linked, a PE-Xb pipe 65% to meet the standard, and a PE-Xc pipe only 60%. The PE-Xc method is also a physical method: no chemical additives are added, so by definition the pipe does not have to be rinsed for sanitary use.

1.1.4 A summary of all the advantages

Temperature- and pressure-resistant

The working temperature may rise to 95°C, and the maximum permitted working pressure amounts to 10 bar.

Minimum linear expansion

The presence of the aluminium layer means the coefficient of expansion of the Henco pipe is comparable with that of copper, and 8 times less than the coefficient of expansion of an ordinary plastic pipe. The coefficient of expansion amounts to 0.025 mm/mK.

Corrosion-resistant

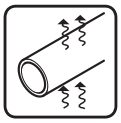
The smooth surface of the pipe prevents build-up of scale or other debris. This means sedimentation and corrosion are avoided. The smoothness of the inner pipe also ensures a minimum pressure loss.

Shape-retaining

After bending, the pipe retains the required shape. It has no thermal memory such as other synthetic pipes. This simplifies and accelerates the installation of the pipe and can reduce the amount of fittings required.

Wear-resistant

The outer and inner pipe are made of electron beam cross-linked polyethylene. As a result, the pipe is not subject to wear, even at high temperatures and flow speeds.



Fully oxygen- and water vapour-proof (diffusion)

The integrated aluminium layer prevents the penetration of oxygen in the pipe. This means corrosion problems with any metal components in the installation are avoided.

Low weight (fast and simple assembly)

Fast and simple installation saves time and money. The Henco pipe is flexible and extremely light. A coil of 200m Henco standard 16x2 weighs a mere 25 kg.

Long life

If the pipe is used according to the specified working pressure and temperature, a working life of at least 50 years is guaranteed.

No noise nuisance

As distinct from metal pipes, no noise nuisance originates due to the liquid flow if the pipe diameter is correctly selected. Contact noises can be avoided by correct assembly.

From drinking water to chemical liquids

The pipe complies with the most stringent toxicological and hygienic requirements. It is 100% suitable for transporting drinking water. The pipe is also resistant to various chemical liquids.

1.2 Technical data

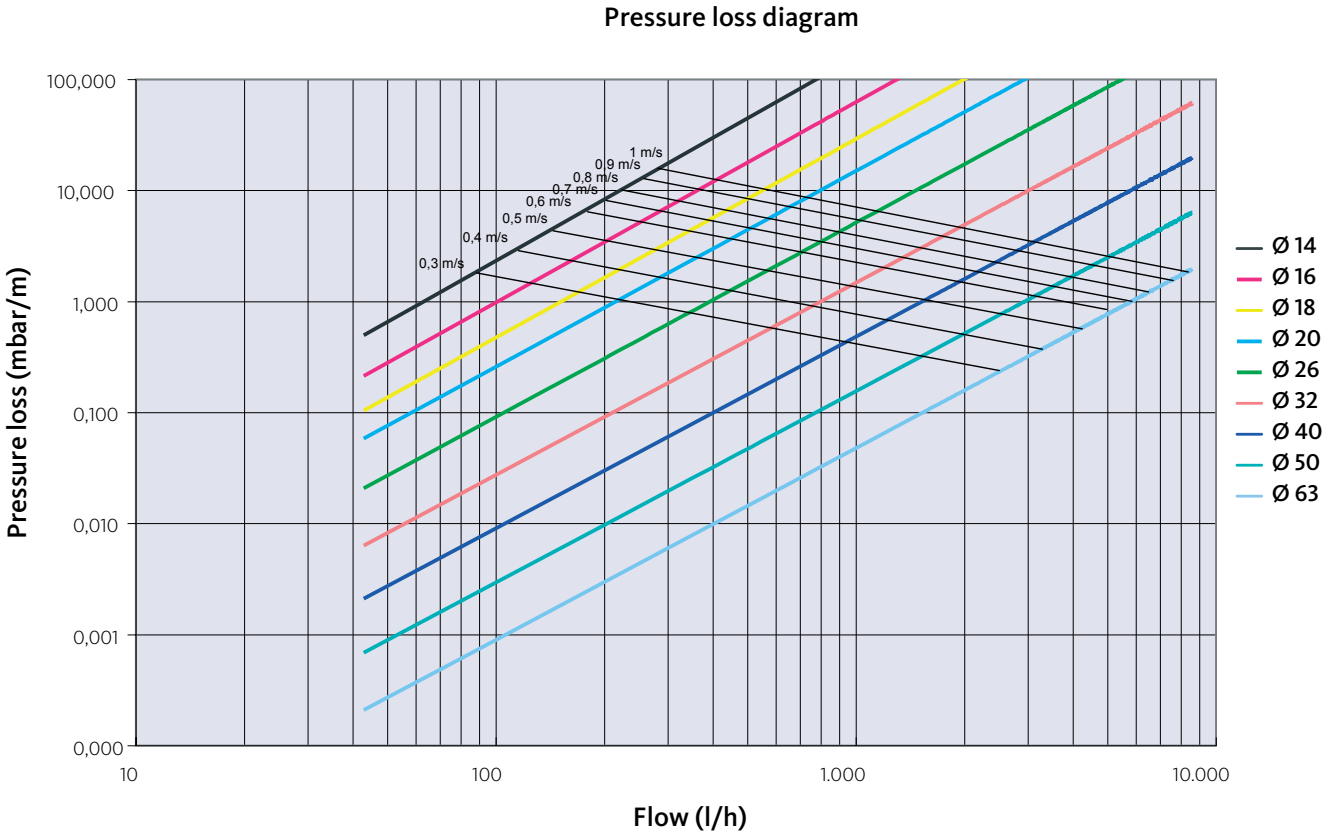
1.2.1 Technical profile of Henco multilayer pipe

Outer diameter (mm)	14	16	16 RIXc	18	20	20 RIXc	26	26 RIXc	32	40	50	63
Inner diameter (mm)	10	12	12	14	16	16	20	20	26	33	42	54
Wall thickness (mm)	2	2	2	2	2	2	3	3	3	3,5	4,0	4,5
Thickness of aluminium (mm)	0,4	0,4	0,2	0,4	0,4	0,28	0,5	0,28	0,7	0,7	0,9	1,2
Max. working temperature (°C)	95	95	95	95	95	95	95	95	95	95	95	95
Max. working pressure (bar)	10	10	10	10	10	10	10	10	10	10	10	10
Coefficient of thermal conduction (W/m/K)	0,43	0,43	0,43	0,43	0,43	0,43	0,43	0,43	0,43	0,43	0,43	0,43
Linear expansion coefficient (mm/m/K)	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025
Surface roughness of inner pipe (µ)	7	7	7	7	7	7	7	7	7	7	7	7
Oxygen diffusion (mg/l)	0	0	0	0	0	0	0	0	0	0	0	0
Smallest bending radius manual / external spiral spring (mm)	5xDu	5xDu	8xDu	5xDu	5xDu	7xDu	5xDu	7xDu	*	*	*	*
Smallest bending radius with internal spiral spring (mm)	3xDu	3xDu	8xDu	3xDu	3xDu	5xDu	3xDu	5xDu	*	*	*	*
Degree of cross-linking (%)	60	60	60	60	60	60	60	60	60	60	60	60
Weight (kg/m)	0,108	0,125	0,101	0,132	0,147	0,129	0,252	0,261	0,39	0,528	0,766	1,155
Water volume (l/m)	0,072	0,113	0,113	0,154	0,201	0,201	0,314	0,314	0,53	0,803	1,32	2,042
Per coil (m)	100 200	50 100 200	100 200	100 200	100	100	50	50	50	-	-	-
Per straight length	4-5	4-5	4-5	4-5	4-5	4-5	4-5	4-5	4-5	4-5	4-5	4-5

* necessary to use elbow fittings

1.2.2 Pressure loss diagram and tables

Each liquid loses energy when it flows through a pipe as a result of the force of friction of the liquid against the walls of the pipe. The diagram and tables show the pressure loss depending on the pipe diameter and the flow speed for a given flow rate.



PE-Xc /AL / PE-Xc
100% QUALITY

1 PIPES

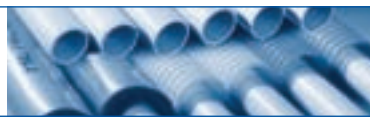
		Diameter 14		Diameter 16		Diameter 18		Diameter 20		Diameter 26		Diameter 32		Diameter 40		Diameter 50		Diameter 63	
Capacity	Flow	Speed	Pressure loss	Speed	Pressure loss	Speed	Pressure loss	Speed	Pressure loss	Speed	Pressure loss	Speed	Pressure loss	Speed	Pressure loss	Speed	Pressure loss	Speed	Pressure loss
(kW/h)	(l/h)	(m/s)	(mbar/m)	(m/s)	(mbar/m)	(m/s)	(mbar/m)	(m/s)	(mbar/m)	(m/s)	(mbar/m)	(m/s)	(mbar/m)	(m/s)	(mbar/m)	(m/s)	(mbar/m)	(m/s)	(mbar/m)
1	43	0,15	0,46	0,11	0,17	0,08	0,07	0,06	0,03	0,04	0,01	0,02	0,00	0,01	0,00	0,01	0,00	0,01	0,00
2	86	0,30	1,50	0,21	0,63	0,16	0,31	0,12	0,16	0,08	0,06	0,05	0,01	0,03	0,00	0,02	0,00	0,01	0,00
3	129	0,46	3,02	0,32	1,28	0,23	0,62	0,18	0,33	0,11	0,11	0,07	0,03	0,04	0,01	0,03	0,00	0,02	0,00
4	172	0,61	4,99	0,42	2,10	0,31	1,01	0,24	0,54	0,15	0,19	0,09	0,05	0,06	0,02	0,03	0,01	0,02	0,00
5	215	0,76	7,37	0,53	3,10	0,39	1,49	0,30	0,79	0,19	0,28	0,11	0,08	0,07	0,03	0,04	0,01	0,03	0,00
6	258	0,91	10,15	0,63	4,26	0,47	2,05	0,36	1,09	0,23	0,38	0,14	0,11	0,08	0,04	0,05	0,01	0,03	0,00
7	301	1,07	13,31	0,74	5,59	0,54	2,68	0,42	1,42	0,27	0,49	0,16	0,14	0,10	0,05	0,06	0,01	0,04	0,00
8	344	1,22	16,85	0,85	7,07	0,62	3,39	0,48	1,80	0,30	0,62	0,18	0,18	0,11	0,06	0,07	0,02	0,04	0,01
9	387	1,37	20,75	0,95	8,70	0,70	4,17	0,54	2,21	0,34	0,77	0,20	0,22	0,13	0,07	0,08	0,02	0,05	0,01
10	430	1,52	25,01	1,06	10,48	0,78	5,02	0,59	2,66	0,38	0,92	0,23	0,27	0,14	0,09	0,09	0,03	0,05	0,01
11	473	1,67	29,62	1,16	12,40	0,85	5,94	0,65	3,15	0,42	1,09	0,25	0,31	0,15	0,10	0,09	0,03	0,06	0,01
12	516	1,83	34,58	1,27	14,46	0,93	6,93	0,71	3,67	0,46	1,27	0,27	0,36	0,17	0,12	0,10	0,04	0,06	0,01
13	559	1,98	39,88	1,37	16,67	1,01	7,98	0,77	4,22	0,49	1,46	0,29	0,42	0,18	0,14	0,11	0,04	0,07	0,01
14	602	2,13	45,51	1,48	19,02	1,09	9,10	0,83	4,81	0,53	1,66	0,32	0,48	0,20	0,15	0,12	0,05	0,07	0,01
15	645	2,28	51,47	1,59	21,50	1,16	10,29	0,89	5,44	0,57	1,88	0,34	0,54	0,21	0,17	0,13	0,06	0,08	0,02
16	688	2,44	57,76	1,69	24,11	1,24	11,54	0,95	6,10	0,61	2,10	0,36	0,60	0,22	0,19	0,14	0,06	0,08	0,02
17	731	2,59	64,38	1,80	26,87	1,32	12,85	1,01	6,79	0,65	2,34	0,38	0,67	0,24	0,22	0,15	0,07	0,09	0,02
18	774	2,74	71,31	1,90	29,75	1,40	14,22	1,07	7,51	0,68	2,59	0,41	0,74	0,25	0,24	0,16	0,08	0,09	0,02
19	817	2,89	78,57	2,01	32,76	1,48	15,66	1,13	8,27	0,72	2,85	0,43	0,82	0,27	0,26	0,16	0,08	0,10	0,03
20	860	3,04	86,14	2,11	35,91	1,55	17,16	1,19	9,06	0,76	3,12	0,45	0,89	0,28	0,29	0,17	0,09	0,10	0,03
21	903	3,20	94,02	2,22	39,18	1,63	18,72	1,25	9,88	0,80	3,40	0,47	0,97	0,29	0,31	0,18	0,10	0,11	0,03
22	946	3,35	102,22	2,33	42,58	1,71	20,34	1,31	10,73	0,84	3,70	0,50	1,06	0,31	0,34	0,19	0,11	0,11	0,03
23	989	3,50	110,72	2,43	46,11	1,79	22,02	1,37	11,62	0,88	4,00	0,52	1,14	0,32	0,37	0,20	0,12	0,12	0,04
24	1032	3,65	119,53	2,54	49,76	1,86	23,76	1,43	12,53	0,91	4,31	0,54	1,23	0,34	0,40	0,21	0,13	0,13	0,04
25	1075	3,81	128,65	2,64	53,54	1,94	25,55	1,49	13,48	0,95	4,64	0,56	1,33	0,35	0,43	0,22	0,14	0,13	0,04
26	1118	3,96	138,07	2,75	57,44	2,02	27,41	1,55	14,45	0,99	4,97	0,59	1,42	0,36	0,46	0,22	0,14	0,14	0,04
27	1161	4,11	147,79	2,85	61,47	2,10	29,33	1,61	15,46	1,03	5,32	0,61	1,52	0,38	0,49	0,23	0,15	0,14	0,05
28	1204	4,26	157,81	2,96	65,62	2,17	31,30	1,66	16,50	1,07	5,67	0,63	1,62	0,39	0,52	0,24	0,16	0,15	0,05
29	1247	4,41	168,13	3,07	69,89	2,25	33,33	1,72	17,57	1,10	6,04	0,65	1,72	0,41	0,55	0,25	0,18	0,15	0,05
30	1290	4,57	178,75	3,17	74,29	2,33	35,42	1,78	18,67	1,14	6,41	0,68	1,83	0,42	0,59	0,26	0,19	0,16	0,06
31	1333	4,72	189,66	3,28	78,80	2,41	37,56	1,84	19,79	1,18	6,80	0,70	1,94	0,43	0,62	0,27	0,20	0,16	0,06
32	1376	4,87	200,87	3,38	83,44	2,49	39,77	1,90	20,95	1,22	7,19	0,72	2,05	0,45	0,66	0,28	0,21	0,17	0,06
33	1419	5,02	212,37	3,49	88,19	2,56	42,02	1,96	22,14	1,26	7,60	0,74	2,17	0,46	0,69	0,28	0,22	0,17	0,07
34	1462	5,18	224,16	3,59	93,07	2,64	44,34	2,02	23,35	1,29	8,01	0,77	2,29	0,48	0,73	0,29	0,23	0,18	0,07
35	1505	5,33	236,24	3,70	98,06	2,72	46,71	2,08	24,60	1,33	8,44	0,79	2,41	0,49	0,77	0,30	0,24	0,18	0,07
36	1548	5,48	248,61	3,81	103,17	2,80	49,14	2,14	25,87	1,37	8,88	0,81	2,53	0,50	0,81	0,31	0,26	0,19	0,08
37	1591	5,63	261,27	3,91	108,40	2,87	51,62	2,20	27,18	1,41	9,32	0,83	2,66	0,52	0,85	0,32	0,27	0,19	0,08
38	1634	5,78	274,22	4,02	113,75	2,95	54,16	2,26	28,51	1,45	9,78	0,86	2,79	0,53	0,89	0,33	0,28	0,20	0,09
39	1677	5,94	287,46	4,12	119,21	3,03	56,75	2,32	29,87	1,48	10,24	0,88	2,92	0,55	0,93	0,34	0,30	0,20	0,09
40	1720	6,09	300,98	4,23	124,79	3,11	59,40	2,38	31,26	1,52	10,71	0,90	3,05	0,56	0,98	0,35	0,31	0,21	0,09
41	1763	6,24	314,78	4,33	130,49	3,18	62,10	2,44	32,68	1,56	11,20	0,92	3,19	0,57	1,02	0,35	0,32	0,21	0,10
42	1806	6,39	328,87	4,44	136,30	3,26	64,85	2,50	34,12	1,60	11,69	0,95	3,33	0,59	1,07	0,36	0,34	0,22	0,10
43	1849	6,55	343,25	4,55	142,23	3,34	67,66	2,56	35,60	1,64	12,20	0,97	3,47	0,60	1,11	0,37	0,35	0,22	0,11
44	1892	6,70	357,90	4,65	148,27	3,42	70,53	2,62	37,10	1,67	12,71	0,99	3,62	0,62	1,16	0,38	0,37	0,23	0,11
45	1935	6,85	372,84	4,76	154,43	3,49	73,45	2,68	38,63	1,71	13,23	1,01	3,76	0,63	1,20	0,39	0,38	0,23	0,11
46	1978	7,00	388,06	4,86	160,70	3,57	76,42	2,74	40,19	1,75	13,76	1,04	3,91	0,64	1,25	0,40	0,40	0,24	0,12
47	2021	7,15	403,56	4,97	167,09	3,65	79,44	2,79	41,78	1,79	14,30	1,06	4,07	0,66	1,30	0,41	0,41	0,25	0,12
48	2064	7,31	419,33	5,07	173,59	3,73	82,52	2,85	43,39	1,83	14,85	1,08	4,22	0,67	1,35	0,41	0,43	0,25	0,13
49	2107	7,46	435,39	5,18	180,20	3,81	85,66	2,91	45,03	1,86	15,41	1,10	4,38	0,68	1,40	0,42	0,44	0,26	0,13
50	2150	7,61	451,72	5,29	186,93	3,88	88,84	2,97	46,70	1,90	15,98	1,13	4,54	0,70	1,45	0,43	0,46	0,26	0,14
51	2193	7,76	468,34	5,39	193,77	3,96	92,08	3,03	48,40	1,94	16,56	1,15	4,71	0,71	1,50	0,44	0,48	0,27	0,14
52	2236	7,92	485,22	5,50	200,72	4,04	95,37	3,09	50,12	1,98	17,15	1,17	4,87	0,73	1,56	0,45	0,49	0,27	0,15
53	2279	8,07	502,39	5,60	207,78	4,12	98,71	3,15	51,87	2,02	17,74	1,19	5,04	0,74	1,61	0,46	0,51	0,28	0,15
54	2322	8,22	519,83	5,71	214,96	4,19	102,11	3,21	53,65	2,05	18,35	1,22	5,21	0,75	1,67	0,47	0,53	0,28	0,16
55	2365	8,37	537,55	5,81	222,25	4,27	105,56	3,27	55,46	2,09	18,96	1,24	5,39	0,77	1,72	0,47	0,54	0,29	0,16
56	2408	8,52	555,54	5,92	229,65	4,35	109,06	3,33	57,29	2,13	19,59	1,26	5,56	0,78	1,78	0,48	0,56	0,29	0,17
57	2451	8,68	573,80	6,03	237,16	4,43	112,61	3,39	59,15	2,17	20,22	1,28	5,74	0,80	1,83	0,49	0,58	0,30	0,17
58	2494	8,83	592,34	6,13	244,78	4,50	116,21	3,45	61,04	2,21	20,86	1,31	5,92	0,81	1,89	0,50	0,60	0,30	0,18
59	2537	8,98	611,15	6,24	252,51	4,58	119,87	3,51	62,96	2,25	21,52	1,33	6,11	0,82	1,95	0,51	0,62	0,31	0,19
60	2580	9,13	630,23	6,34	260,35	4,66	123,58	3,57	64,90	2,28	22,18	1,35	6,29	0,84	2,01	0,52	0,63	0,31	0,19
61	2623	9,29	649,58	6,45	268,30	4,74	127,34	3,63	66,87	2,32	22,85	1,37	6,48	0,85	2,07	0,53	0,65	0,32	0,20
62	2666	9,44	669,21	6,55	276,37	4,82	131,15	3,69	68,86	2,36	23,52	1,40	6,68	0,87	2,13	0,54	0,67	0,32	0,20
63	2709	9,59	689,11	6,66	284,54	4,89	135,01	3,75	70,88	2,40	24,21	1,42	6,87	0,88	2,19	0,54	0,69	0,33	0,21
64	2752	9,74	709,28	6,77	292,82	4,97	138,93	3,81	72,93	2,44	24,91	1,44	7,07	0,89	2,25	0,55	0,71	0,33	0,21
65	2795	9,89	729,71	6,87	301,21	5,05	142,89	3,86	75,01	2,47	25,61	1,46	7,27	0,91	2,32	0,56	0,73	0,34	0,22
66	2838	10,05	750,42	6,98	309,71	5,13	146,91	3,92	77,11	2,51	26,33	1,49	7,47	0,92	2,38	0,57	0,75	0,34	0,23
67	2881	10,20	771,40	7,08	318,32	5,20	150,97	3,98	79,24	2,55	27,05	1,51	7,67	0,94	2,45	0,58	0,77	0,35	0,23

Medium: water at 70°C

P = Q x ΔT x 1,163
= capacity in Watt

1 mbar/m = 100 Pa/m

HENCO



		Diameter 14		Diameter 16		Diameter 18		Diameter 20		Diameter 26		Diameter 32		Diameter 40		Diameter 50		Diameter 63	
Capacity	Flow	Speed	Pressure loss	Speed	Pressure loss	Speed	Pressure loss	Speed	Pressure loss	Speed	Pressure loss	Speed	Pressure loss	Speed	Pressure loss	Speed	Pressure loss	Speed	Pressure loss
(kW/h)	(l/h)	(m/s)	(mbar/m)	(m/s)	(mbar/m)	(m/s)	(mbar/m)	(m/s)	(mbar/m)	(m/s)	(mbar/m)	(m/s)	(mbar/m)	(m/s)	(mbar/m)	(m/s)	(mbar/m)	(m/s)	(mbar/m)
67	2881	10,20	771,40	7,08	318,32	5,20	150,97	3,98	79,24	2,55	27,05	1,51	7,67	0,94	2,45	0,58	0,77	0,35	0,23
68	2924	10,35	792,65	7,19	327,04	5,28	155,09	4,04	81,39	2,59	27,78	1,53	7,88	0,95	2,51	0,59	0,79	0,35	0,24
70	3010	10,66	835,94	7,40	344,80	5,44	163,48	4,16	85,78	2,66	29,27	1,58	8,30	0,98	2,65	0,60	0,83	0,37	0,25
71	3053	10,81	857,99	7,51	353,85	5,51	167,75	4,22	88,01	2,70	30,03	1,60	8,51	0,99	2,71	0,61	0,86	0,37	0,26
72	3096	10,96	880,31	7,61	363,00	5,59	172,07	4,28	90,27	2,74	30,80	1,62	8,73	1,01	2,78	0,62	0,88	0,38	0,26
73	3139	11,11	902,90	7,72	372,26	5,67	176,44	4,34	92,56	2,78	31,58	1,64	8,95	1,02	2,85	0,63	0,90	0,38	0,27
74	3182	11,26	925,75	7,82	381,63	5,75	180,86	4,40	94,87	2,82	32,36	1,67	9,17	1,03	2,92	0,64	0,92	0,39	0,28
75	3225	11,42	948,87	7,93	391,10	5,82	185,33	4,46	97,21	2,85	33,15	1,69	9,39	1,05	2,99	0,65	0,94	0,39	0,28
76	3268	11,57	972,25	8,03	400,68	5,90	189,86	4,52	99,57	2,89	33,96	1,71	9,62	1,06	3,07	0,66	0,97	0,40	0,29
77	3311	11,72	995,90	8,14	410,37	5,98	194,43	4,58	101,96	2,93	34,77	1,73	9,85	1,08	3,14	0,66	0,99	0,40	0,30
78	3354	11,87	1019,82	8,25	420,17	6,06	199,05	4,64	104,38	2,97	35,59	1,76	10,08	1,09	3,21	0,67	1,01	0,41	0,30
79	3397	12,03	1044,00	8,35	430,07	6,14	203,72	4,70	106,82	3,01	36,42	1,78	10,31	1,10	3,29	0,68	1,04	0,41	0,31
80	3440	12,18	1068,44	8,46	440,08	6,21	208,44	4,76	109,28	3,04	37,25	1,80	10,55	1,12	3,36	0,69	1,06	0,42	0,32
81	3483	12,33	1093,15	8,56	450,20	6,29	213,21	4,82	111,78	3,08	38,10	1,82	10,79	1,13	3,44	0,70	1,08	0,42	0,33
82	3526	12,48	1118,13	8,67	460,43	6,37	218,03	4,88	114,30	3,12	38,95	1,85	11,03	1,15	3,51	0,71	1,11	0,43	0,33
83	3569	12,63	1143,36	8,77	470,76	6,45	222,90	4,94	116,84	3,16	39,82	1,87	11,27	1,16	3,59	0,72	1,13	0,43	0,34
84	3612	12,79	1168,86	8,88	481,19	6,52	227,82	4,99	119,41	3,20	40,69	1,89	11,52	1,17	3,67	0,72	1,16	0,44	0,35
85	3655	12,94	1194,63	8,99	491,74	6,60	232,79	5,05	122,01	3,23	41,57	1,91	11,76	1,19	3,75	0,73	1,18	0,44	0,35
86	3698	13,09	1220,66	9,09	502,38	6,68	237,81	5,11	124,63	3,27	42,46	1,94	12,01	1,20	3,83	0,74	1,20	0,45	0,36
87	3741	13,24	1246,95	9,20	513,14	6,76	242,88	5,17	127,27	3,31	43,35	1,96	12,27	1,22	3,91	0,75	1,23	0,45	0,37
88	3784	13,40	1273,50	9,30	524,00	6,83	248,00	5,23	129,95	3,35	44,26	1,98	12,52	1,23	3,99	0,76	1,26	0,46	0,38
89	3827	13,55	1300,31	9,41	534,97	6,91	253,16	5,29	132,65	3,39	45,17	2,00	12,78	1,24	4,07	0,77	1,28	0,46	0,38
90	3870	13,70	1327,39	9,51	546,04	6,99	258,38	5,35	135,37	3,42	46,10	2,03	13,04	1,26	4,15	0,78	1,31	0,47	0,39
91	3913	13,85	1354,73	9,62	557,21	7,07	263,65	5,41	138,12	3,46	47,03	2,05	13,30	1,27	4,23	0,79	1,33	0,48	0,40
92	3956	14,00	1382,33	9,73	568,50	7,15	268,96	5,47	140,89	3,50	47,97	2,07	13,57	1,29	4,32	0,79	1,36	0,48	0,41
93	3999	14,16	1410,19	9,83	579,88	7,22	274,32	5,53	143,69	3,54	48,92	2,09	13,83	1,30	4,40	0,80	1,39	0,49	0,42
94	4042	14,31	1438,31	9,94	591,38	7,30	279,73	5,59	146,52	3,58	49,87	2,12	14,10	1,31	4,49	0,81	1,41	0,49	0,42
95	4085	14,46	1466,69	10,04	602,97	7,38	285,19	5,65	149,37	3,62	50,84	2,14	14,37	1,33	4,57	0,82	1,44	0,50	0,43
96	4128	14,61	1495,34	10,15	614,67	7,46	290,70	5,71	152,24	3,65	51,81	2,16	14,65	1,34	4,66	0,83	1,47	0,50	0,44
97	4171	14,77	1524,24	10,25	626,48	7,53	296,26	5,77	155,14	3,69	52,79	2,18	14,92	1,36	4,75	0,84	1,49	0,51	0,45
98	4214	14,92	1553,41	10,36	638,39	7,61	301,87	5,83	158,07	3,73	53,78	2,21	15,20	1,37	4,84	0,85	1,52	0,51	0,46
99	4257	15,07	1582,83	10,47	650,41	7,69	307,52	5,89	161,02	3,77	54,78	2,23	15,48	1,38	4,92	0,85	1,55	0,52	0,47
100	4300	15,22	1612,51	10,57	662,53	7,77	313,23	5,95	163,99	3,81	55,79	2,25	15,77	1,40	5,01	0,86	1,58	0,52	0,47
101	4343	15,37	1642,45	10,68	674,75	7,84	318,98	6,01	166,99	3,84	56,80	2,27	16,05	1,41	5,11	0,87	1,61	0,53	0,48
102	4386	15,53	1672,66	10,78	687,08	7,92	324,78	6,07	170,02	3,88	57,83	2,30	16,34	1,43	5,20	0,88	1,63	0,53	0,49
103	4429	15,68	1703,12	10,89	699,51	8,00	330,63	6,12	173,07	3,92	58,86	2,32	16,63	1,44	5,29	0,89	1,66	0,54	0,50
104	4472	15,83	1733,84	10,99	712,05	8,08	336,53	6,18	176,15	3,96	59,90	2,34	16,92	1,45	5,38	0,90	1,69	0,54	0,51
105	4515	15,98	1764,82	11,10	724,69	8,15	342,47	6,24	179,25	4,00	60,95	2,36	17,22	1,47	5,47	0,91	1,72	0,55	0,52
106	4558	16,14	1796,05	11,21	737,44	8,23	348,47	6,30	182,37	4,03	62,01	2,39	17,51	1,48	5,57	0,91	1,75	0,55	0,53
107	4601	16,29	1827,55	11,31	750,28	8,31	354,51	6,36	185,52	4,07	63,07	2,41	17,81	1,50	5,66	0,92	1,78	0,56	0,53
108	4644	16,44	1859,30	11,42	763,24	8,39	360,60	6,42	188,70	4,11	64,15	2,43	18,11	1,51	5,76	0,93	1,81	0,56	0,54
109	4687	16,59	1891,31	11,52	776,29	8,47	366,74	6,48	191,90	4,15	65,23	2,45	18,42	1,52	5,85	0,94	1,84	0,57	0,55
110	4730	16,74	1923,58	11,63	789,45	8,54	372,92	6,54	195,12	4,19	66,32	2,48	18,72	1,54	5,95	0,95	1,87	0,57	0,56
111	4773	16,90	1956,11	11,73	802,71	8,62	379,16	6,60	198,37	4,22	67,42	2,50	19,03	1,55	6,05	0,96	1,90	0,58	0,57
112	4816	17,05	1988,89	11,84	816,08	8,70	385,44	6,66	201,65	4,26	68,53	2,52	19,34	1,57	6,15	0,97	1,93	0,58	0,58
113	4859	17,20	2021,93	11,95	829,54	8,78	391,77	6,72	204,95	4,30	69,64	2,54	19,66	1,58	6,25	0,98	1,96	0,59	0,59
114	4902	17,35	2055,23	12,05	843,12	8,85	398,15	6,78	208,27	4,34	70,76	2,57	19,97	1,59	6,35	0,98	2,00	0,60	0,60
115	4945	17,51	2088,79	12,16	856,79	8,93	404,58	6,84	211,62	4,38	71,90	2,59	20,29	1,61	6,45	0,99	2,03	0,60	0,61
116	4988	17,66	2122,60	12,26	870,57	9,01	411,05	6,90	215,00	4,41	73,04	2,61	20,61	1,62	6,55	1,00	2,06	0,61	0,62
117	5031	17,81	2156,67	12,37	884,45	9,09	417,57	6,96	218,39	4,45	74,18	2,63	20,93	1,64	6,65	1,01	2,09	0,61	0,63
118	5074	17,96	2190,99	12,47	898,43	9,16	424,14	7,02	221,82	4,49	75,34	2,66	21,26	1,65	6,75	1,02	2,12	0,62	0,64
119	5117	18,11	2225,57	12,58	912,52	9,24	430,76	7,08	225,26	4,53	76,50	2,68	21,58	1,66	6,86	1,03	2,15	0,62	0,65
120	5160	18,27	2260,41	12,69	926,70	9,32	437,42	7,14	228,74	4,57	77,68	2,70	21,91	1,68	6,96	1,04	2,19	0,63	0,66
121	5203	18,42	2295,50	12,79	940,99	9,40	444,13	7,19	232,23	4,60	78,86	2,72	22,24	1,69	7,07	1,04	2,22	0,63	0,67
122	5246	18,57	2330,85	12,90	955,39	9,47	450,89	7,25	235,75	4,64	80,05	2,75	22,58	1,71	7,17	1,05	2,25	0,64	0,68
123	5289	18,72	2366,46	13,00	969,88	9,55	457,70	7,31	239,30	4,68	81,24	2,77	22,91	1,72	7,28	1,06	2,29	0,64	0,69
124	5332	18,88	2402,32	13,11	984,48	9,63	464,55	7,37	242,87	4,72	82,45	2,79	23,25	1,73	7,38	1,07	2,32	0,65	0,70
125	5375	19,03	2438,43	13,21	999,18	9,71	471,46	7,43	246,46	4,76	83,66	2,81	23,59	1,75	7,49	1,08	2,35	0,65	0,71
126	5418	19,18	2474,80	13,32	1013,98	9,79	478,40	7,49	250,08	4,79	84,88	2,84	23,93	1,76	7,60	1,09	2,39	0,66	0,72
127	5461	19,33	2511,43	13,42	1028,89	9,86	485,40	7,55	253,72	4,83	86,11	2,86	24,28	1,78	7,71	1,10	2,42	0,66	0,73
128	5504	19,48	2548,31	13,53	1043,89	9,94	492,45	7,61	257,39	4,87	87,35	2,88	24,63	1,79	7,82	1,10	2,46	0,67	0,74
129	5547	19,64	2585,44	13,64	1059,00	10,02	499,54	7,67	261,08	4,91	88,60	2,90	24,98	1,80	7,93	1,11	2,49	0,67	0,75
130	5590	19,79	2622,83	13,74	1074,21	10,10	506,67	7,73	264,80	4,95	89,85	2,93	25,33	1,82	8,04	1,12	2,53	0,68	0,76
131	5633	19,94	2660,48	13,85	1089,52	10,17	513,86	7,79	268,54	4,99	91,11	2,95	25,68	1,83	8,15	1,13	2,56	0,68	0,77
132	5676	20,09	2698,37	13,95	1104,94	10,25	521,09	7,85	272,30	5,02	92,38	2,97	26,04	1,85	8,26	1,14	2,60	0,69	0,78
133	5719	20,25	2736,53	14,06	1120,45	10,33	528,37	7,91	276,09	5,06	93,66	2,99	26,40	1,86	8,38	1,15	2,63	0,69	0,79
134	5762	20,40	2774,93	14,16	1136,07	10,41	535,70	7,97	279,91	5,10	94,95	3,02	26,76	1,87	8,49	1,16	2,67	0,70	0,80

Medium: water at 70°C

P = Q x ΔT x 1,163
= capacity in Watt

1 mbar/m = 100 Pa/m

1 PIPES

		Diameter 14		Diameter 16		Diameter 18		Diameter 20		Diameter 26		Diameter 32		Diameter 40		Diameter 50		Diameter 63	
Capacity	Flow	Speed	Pressure loss	Speed	Pressure loss	Speed	Pressure loss	Speed	Pressure loss	Speed	Pressure loss	Speed	Pressure loss	Speed	Pressure loss	Speed	Pressure loss	Speed	Pressure loss
(kW/h)	(l/h)	(m/s)	(mbar/m)	(m/s)	(mbar/m)	(m/s)	(mbar/m)	(m/s)	(mbar/m)	(m/s)	(mbar/m)	(m/s)	(mbar/m)	(m/s)	(mbar/m)	(m/s)	(mbar/m)	(m/s)	(mbar/m)
135	5805	20,55	2813,60	14,27	1151,79	10,48	543,07	8,03	283,74	5,14	96,24	3,04	27,12	1,89	8,61	1,16	2,70	0,70	0,81
136	5848	20,70	2852,51	14,38	1167,61	10,56	550,49	8,09	287,61	5,18	97,54	3,06	27,48	1,90	8,72	1,17	2,74	0,71	0,82
137	5891	20,85	2891,68	14,48	1183,53	10,64	557,96	8,15	291,49	5,21	98,85	3,08	27,85	1,91	8,84	1,18	2,77	0,72	0,83
138	5934	21,01	2931,10	14,59	1199,55	10,72	565,47	8,21	295,40	5,25	100,17	3,11	28,22	1,93	8,95	1,19	2,81	0,72	0,84
139	5977	21,16	2970,78	14,69	1215,68	10,80	573,04	8,27	299,34	5,29	101,50	3,13	28,59	1,94	9,07	1,20	2,85	0,73	0,85
140	6020	21,31	3010,71	14,80	1231,90	10,87	580,64	8,32	303,29	5,33	102,83	3,15	28,97	1,96	9,19	1,21	2,88	0,73	0,86
141	6063	21,46	3050,89	14,90	1248,23	10,95	588,30	8,38	307,28	5,37	104,18	3,18	29,34	1,97	9,31	1,22	2,92	0,74	0,88
142	6106	21,62	3091,32	15,01	1264,66	11,03	596,00	8,44	311,28	5,40	105,53	3,20	29,72	1,98	9,43	1,23	2,96	0,74	0,89
143	6149	21,77	3132,01	15,12	1281,19	11,11	603,75	8,50	315,31	5,44	106,89	3,22	30,10	2,00	9,55	1,23	3,00	0,75	0,90
144	6192	21,92	3172,96	15,22	1297,82	11,18	611,55	8,56	319,37	5,48	108,25	3,24	30,48	2,01	9,67	1,24	3,03	0,75	0,91
145	6235	22,07	3214,15	15,33	1314,55	11,26	619,39	8,62	323,45	5,52	109,63	3,27	30,87	2,03	9,79	1,25	3,07	0,76	0,92
146	6278	22,22	3255,60	15,43	1331,38	11,34	627,28	8,68	327,55	5,56	111,01	3,29	31,25	2,04	9,91	1,26	3,11	0,76	0,93
147	6321	22,38	3297,30	15,54	1348,31	11,42	635,21	8,74	331,68	5,59	112,40	3,31	31,64	2,05	10,04	1,27	3,15	0,77	0,94
148	6364	22,53	3339,25	15,64	1365,34	11,49	643,19	8,80	335,83	5,63	113,80	3,33	32,04	2,07	10,16	1,28	3,19	0,77	0,95
149	6407	22,68	3381,45	15,75	1382,48	11,57	651,22	8,86	340,00	5,67	115,20	3,36	32,43	2,08	10,28	1,29	3,23	0,78	0,97
150	6450	22,83	3423,91	15,86	1399,71	11,65	659,30	8,92	344,20	5,71	116,62	3,38	32,82	2,10	10,41	1,29	3,27	0,78	0,98
151	6493	22,99	3466,62	15,96	1417,05	11,73	667,42	8,98	348,43	5,75	118,04	3,40	33,22	2,11	10,53	1,30	3,31	0,79	0,99
152	6536	23,14	3509,58	16,07	1434,49	11,80	675,59	9,04	352,67	5,78	119,47	3,42	33,62	2,12	10,66	1,31	3,34	0,79	1,00
153	6579	23,29	3552,80	16,17	1452,02	11,88	683,80	9,10	356,94	5,82	120,91	3,45	34,03	2,14	10,79	1,32	3,38	0,80	1,01
154	6622	23,44	3596,26	16,28	1469,66	11,96	692,07	9,16	361,24	5,86	122,35	3,47	34,43	2,15	10,92	1,33	3,42	0,80	1,03
155	6665	23,59	3639,98	16,38	1487,40	12,04	700,37	9,22	365,56	5,90	123,81	3,49	34,84	2,17	11,04	1,34	3,46	0,81	1,04
156	6708	23,75	3683,95	16,49	1505,23	12,12	708,73	9,28	369,90	5,94	125,27	3,51	35,25	2,18	11,17	1,35	3,50	0,81	1,05
157	6751	23,90	3728,17	16,60	1523,17	12,19	717,13	9,34	374,26	5,97	126,74	3,54	35,66	2,19	11,30	1,35	3,55	0,82	1,06
158	6794	24,05	3772,64	16,70	1541,21	12,27	725,57	9,39	378,65	6,01	128,22	3,56	36,07	2,21	11,43	1,36	3,59	0,82	1,07
159	6837	24,20	3817,37	16,81	1559,35	12,35	734,07	9,45	383,07	6,05	129,70	3,58	36,49	2,22	11,56	1,37	3,63	0,83	1,09
160	6880	24,36	3862,34	16,91	1577,59	12,43	742,61	9,51	387,50	6,09	131,20	3,60	36,90	2,24	11,70	1,38	3,67	0,84	1,10
161	6923	24,51	3907,57	17,02	1595,93	12,50	751,19	9,57	391,97	6,13	132,70	3,63	37,32	2,25	11,83	1,39	3,71	0,84	1,11
162	6966	24,66	3953,05	17,12	1614,37	12,58	759,82	9,63	396,45	6,16	134,21	3,65	37,75	2,26	11,96	1,40	3,75	0,85	1,12
163	7009	24,81	3998,77	17,23	1632,91	12,66	768,50	9,69	400,96	6,20	135,72	3,67	38,17	2,28	12,10	1,41	3,79	0,85	1,14
164	7052	24,96	4044,75	17,34	1651,55	12,74	777,23	9,75	405,49	6,24	137,25	3,69	38,60	2,29	12,23	1,42	3,84	0,86	1,15
165	7095	25,12	4090,99	17,44	1670,29	12,81	786,00	9,81	410,05	6,28	138,78	3,72	39,02	2,31	12,37	1,42	3,88	0,86	1,16
166	7138	25,27	4137,47	17,55	1689,13	12,89	794,81	9,87	414,63	6,32	140,32	3,74	39,45	2,32	12,50	1,43	3,92	0,87	1,17
167	7181	25,42	4184,20	17,65	1708,06	12,97	803,68	9,93	419,23	6,36	141,87	3,76	39,89	2,33	12,64	1,44	3,96	0,87	1,19
168	7224	25,57	4231,18	17,76	1727,10	13,05	812,59	9,99	423,86	6,39	143,43	3,78	40,32	2,35	12,78	1,45	4,01	0,88	1,20
169	7267	25,73	4278,42	17,86	1746,24	13,13	821,54	10,05	428,51	6,43	144,99	3,81	40,76	2,36	12,91	1,46	4,05	0,88	1,21
170	7310	25,88	4325,90	17,97	1765,48	13,20	830,54	10,11	433,19	6,47	146,56	3,83	41,20	2,38	13,05	1,47	4,09	0,89	1,22
171	7353	26,03	4373,63	18,08	1784,82	13,28	839,59	10,17	437,88	6,51	148,14	3,85	41,64	2,39	13,19	1,48	4,14	0,89	1,24
172	7396	26,18	4421,62	18,18	1804,26	13,36	848,68	10,23	442,61	6,55	149,73	3,87	42,08	2,40	13,33	1,48	4,18	0,90	1,25
173	7439	26,33	4469,85	18,29	1823,80	13,44	857,82	10,29	447,35	6,58	151,33	3,90	42,53	2,42	13,47	1,49	4,22	0,90	1,26
174	7482	26,49	4518,34	18,39	1843,43	13,51	867,00	10,35	452,12	6,62	152,93	3,92	42,98	2,43	13,61	1,50	4,27	0,91	1,28
175	7525	26,64	4567,08	18,50	1863,17	13,59	876,24	10,41	456,91	6,66	154,54	3,94	43,43	2,45	13,75	1,51	4,31	0,91	1,29
176	7568	26,79	4616,06	18,60	1883,01	13,67	885,51	10,47	461,73	6,70	156,16	3,96	43,88	2,46	13,90	1,52	4,36	0,92	1,30
177	7611	26,94	4665,30	18,71	1902,94	13,75	894,83	10,52	466,57	6,74	157,79	3,99	44,33	2,47	14,04	1,53	4,40	0,92	1,32
178	7654	27,10	4714,78	18,82	1922,98	13,82	904,20	10,58	471,43	6,77	159,42	4,01	44,79	2,49	14,18	1,54	4,45	0,93	1,33
179	7697	27,25	4764,52	18,92	1943,11	13,90	913,62	10,64	476,32	6,81	161,06	4,03	45,25	2,50	14,33	1,54	4,49	0,93	1,34
180	7740	27,40	4814,50	19,03	1963,34	13,98	923,08	10,70	481,23	6,85	162,71	4,05	45,71	2,52	14,47	1,55	4,54	0,94	1,36
181	7783	27,55	4864,74	19,13	1983,68	14,06	932,58	10,76	486,16	6,89	164,37	4,08	46,17	2,53	14,62	1,56	4,58	0,94	1,37
182	7826	27,70	4915,22	19,24	2004,11	14,13	942,14	10,82	491,12	6,93	166,04	4,10	46,64	2,54	14,77	1,57	4,63	0,95	1,38
183	7869	27,86	4965,96	19,34	2024,64	14,21	951,73	10,88	496,10	6,96	167,71	4,12	47,11	2,56	14,91	1,58	4,67	0,96	1,40
184	7912	28,01	5016,94	19,45	2045,27	14,29	961,38	10,94	501,11	7,00	169,39	4,14	47,57	2,57	15,06	1,59	4,72	0,96	1,41
185	7955	28,16	5068,17	19,56	2066,00	14,37	971,06	11,00	506,14	7,04	171,08	4,17	48,05	2,59	15,21	1,60	4,77	0,97	1,43
186	7998	28,31	5119,65	19,66	2086,83	14,45	980,80	11,06	511,19	7,08	172,78	4,19	48,52	2,60	15,36	1,61	4,81	0,97	1,44
187	8041	28,47	5171,38	19,77	2107,76	14,52	990,58	11,12	516,26	7,12	174,48	4,21	49,00	2,61	15,51	1,61	4,86	0,98	1,45
188	8084	28,62	5223,37	19,87	2128,79	14,60	1000,40	11,18	521,36	7,15	176,19	4,23	49,47	2,63	15,66	1,62	4,91	0,98	1,47
189	8127	28,77	5275,60	19,98	2149,91	14,68	1010,28	11,24	526,48	7,19	177,91	4,26	49,95	2,64	15,81	1,63	4,95	0,99	1,48
190	8170	28,92	5328,07	20,08	2171,14	14,76	1020,19	11,30	531,63	7,23	179,64	4,28	50,44	2,66	15,96	1,64	5,00	0,99	1,50
191	8213	29,07	5380,80	20,19	2192,46	14,83	1030,16	11,36	536,80	7,27	181,38	4,30	50,92	2,67	16,12	1,65	5,05	1,00	1,51
192	8256	29,23	5433,78	20,30	2213,89	14,91	1040,16	11,42	541,99	7,31	183,12	4,32	51,41	2,68	16,27	1,66	5,10	1,00	1,52
193	8299	29,38	5487,00	20,40	2235,41	14,99	1050,22	11,48	547,20	7,34	184,87	4,35	51,89	2,70	16,42	1,67	5,14	1,01	1,54
194	8342	29,53	5540,48	20,51	2257,03	15,07	1060,32	11,54	552,44	7,38	186,63	4,37	52,38	2,71	16,58	1,67	5,19	1,01	1,55
195	8385	29,68	5594,20	20,61	2278,75	15,14	1070,46	11,59	557,70	7,42	188,39	4,39	52,88	2,73	16,73	1,68	5,24	1,02	1,57
196	8428	29,84	5648,17	20,72	2300,57	15,22	1080,65	11,65	562,99	7,46	190,17	4,41	53,37	2,74	16,89	1,69	5,29	1,02	1,58
197	8471	29,99	5702,39	20,82	2322,49	15,30	1090,89	11,71	568,30	7,50	191,95	4,44	53,87	2,75	17,04	1,70	5,34	1,03	1,60
198	8514	30,14	5756,86	20,93	2344,50	15,38	1101,17	11,77	573,63	7,53	193,74	4,46	54,37	2,77	17,20	1,71	5,39	1,03	1,61
199	8557	30,29	5811,58	21,04	2366,62	15,45	1111,50	11,83	578,98	7,57	195,54	4,48	54,87	2,78	17,36	1,72	5,44	1,04	1,63
200	8600	30,44	5866,55	21,14	2388,83	15,53	1121,87	11,89	584,36	7,61	197,34	4,50	55,37	2,80	17,52	1,73	5,49	1,04	1,64

Medium: water at 70°C

P = Q x ΔT x 1,163
= capacity in Watt

1 mbar/m = 100 Pa/m

1.2.3 Overview of flow loss coefficients (Zeta values)

Besides when the liquid flows through a pipe, it also loses energy when its changes direction. The liquid must then overcome extra resistance. The table below gives an overview of the flow loss coefficients of the different auxiliary parts and the corresponding number of metres of piping.

Auxiliary parts		Zeta values								
		Ø14	Ø16	Ø18	Ø20	Ø26	Ø32	Ø40	Ø50	Ø63
Curved bend		1,50	1,25	1,10	1,85	0,70	-	-	-	-
90° bend		4,20	3,40	2,80	2,05	1,40	1,00	0,80	0,55	0,50
90° T-piece	T-piece flow separator	5,20	4,45	3,85	3,20	1,70	1,20	0,85	0,70	0,65
	T-piece passage	4,00	3,05	2,25	1,35	0,85	0,55	0,40	0,35	0,30
	T-piece up cut with flow separator	4,30	4,15	3,10	1,95	1,50	1,10	0,90	0,75	0,70
	T-piece up cut with flow joint	4,30	4,15	3,10	1,95	1,50	1,10	0,90	0,75	0,70
Wall plate		3,25	2,80	2,55	2,15	1,30	-	-	-	-
Transition reduction		4,20	3,40	2,80	2,05	1,40	1,00	0,80	0,55	0,50
Fitting	(straight connector)	2,50	2,00	1,50	0,95	0,35	0,25	0,20	0,20	0,10

Auxiliary parts		Equivalent pipe length/m								
		Ø14	Ø16	Ø18	Ø20	Ø26	Ø32	Ø40	Ø50	Ø63
Curved bend		0,74	0,65	0,61	0,50	0,49	-	-	-	-
90° bend		1,65	1,50	1,35	1,20	1,10	1,00	1,20	1,20	1,30
90° T-piece	T-piece flow separator	1,65	1,60	1,55	1,50	1,45	1,35	1,30	1,30	1,40
	T-piece passage	1,60	1,30	1,00	0,70	0,75	0,60	0,60	0,70	0,70
	T-piece up cut with flow separator	1,90	1,70	1,50	1,30	1,25	1,20	1,40	1,40	1,50
	T-piece up cut with flow joint	1,90	1,70	1,50	1,30	1,25	1,20	1,40	1,40	1,50
Wall plate		1,28	1,30	1,33	1,35	1,10	-	-	-	-
Transition reduction		1,65	1,50	1,35	1,20	1,10	1,00	1,20	1,20	1,30
Fitting	(straight connector)	1,05	0,90	0,75	0,60	0,30	0,25	0,30	0,40	0,30

1.2.4 Expansion table

All materials used in manufacturing the pipe expand when they warmed and shrink when they cool down. So, account must always be taken of length differences as a result of variations in temperature. The temperature difference and the length of the pipe are the two parameters that will determine the change in length. This can be calculated using the following table.

Expansion (mm/m)	Temperature difference (ΔT)							
Pipe length (m)	10	20	30	40	50	60	70	80
1	0,25	0,50	0,75	1,00	1,25	1,50	1,75	2,00
2	0,50	1,00	1,50	2,00	2,50	3,00	3,50	4,00
3	0,75	1,50	2,25	3,00	3,75	4,50	5,25	6,00
4	1,00	2,00	3,00	4,00	5,00	6,00	7,00	8,00
5	1,25	2,50	3,75	5,00	6,25	7,50	8,75	10,00
6	1,50	3,00	4,50	6,00	7,50	9,00	10,50	12,00
7	1,75	3,50	5,25	7,00	8,75	10,50	12,25	14,00
8	2,00	4,00	6,00	8,00	10,00	12,00	14,00	16,00
9	2,25	4,50	6,75	9,00	11,25	13,50	15,75	18,00
10	2,50	5,00	7,50	10,00	12,50	15,00	17,50	20,00

The expansion table is drawn up based on the formula:

$$\Delta L = L \times \alpha \times \Delta T$$

With: ΔL = change in length
L = pipe length
α = coefficient of expansion
ΔT = temperature difference

where the coefficient of expansion amounts to 0.025 mm/mK irrespective of the diameter of the pipe.

Example:

Given: L = *8 m*
α = *0,025 mm/mK*
ΔT = *50°C (at Tmin=20°C and Tmax=70°C)*

Asked: ΔL

Solution: *Consult the expansion table or apply the formula.*

Table: ΔL = *10,0 mm*

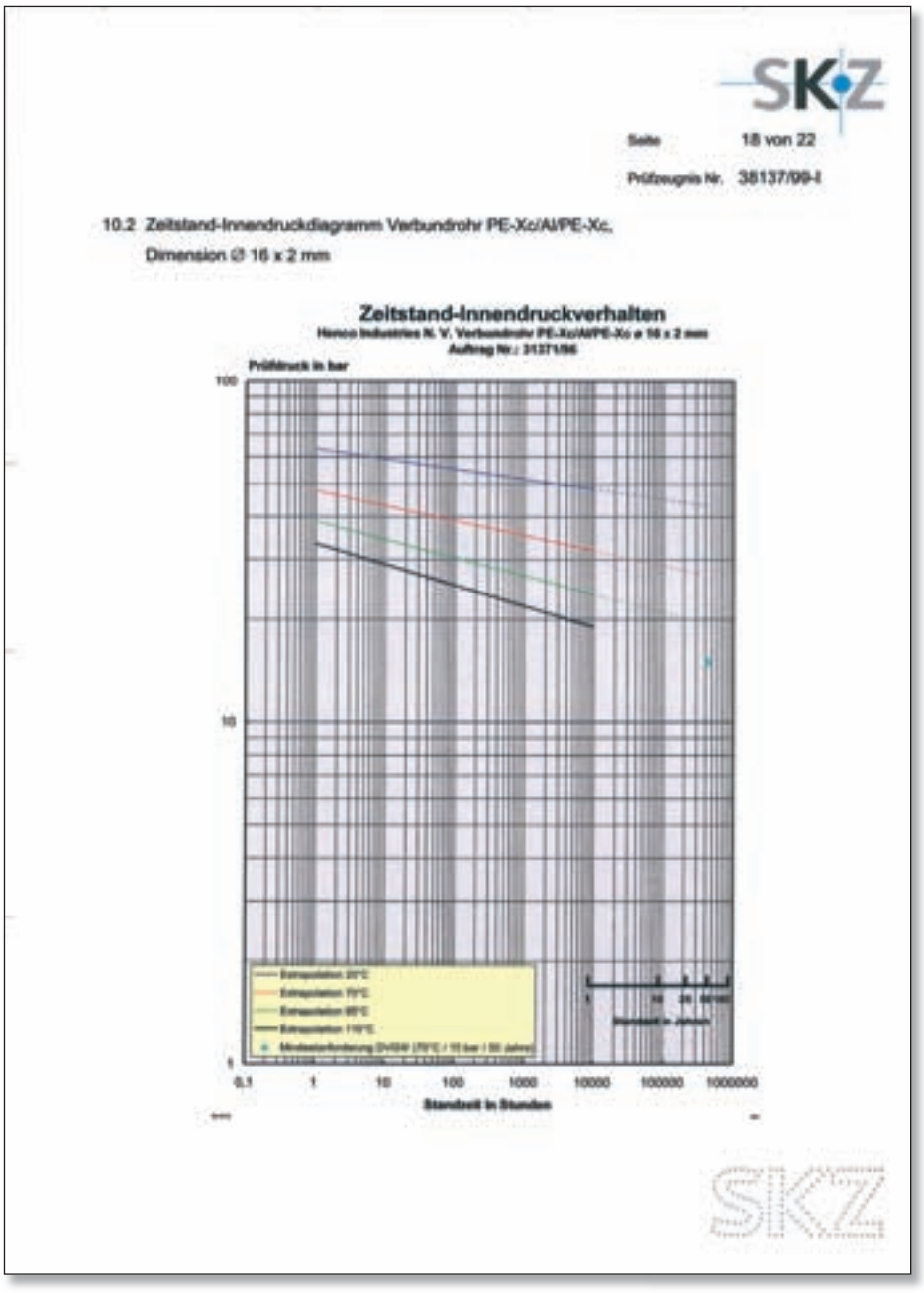
Formula: $\Delta L = L \times \alpha \times \Delta T$
$\Delta L = 8 \times 0{,}025 \times 50$
ΔL = *10,0 mm*

The expansion of the pipe must be considered when designing an installation.

1.2.5 Regression curve (working life)

The working life of the multilayer pipe depends on the temperature and pressure in the pipe. The straight lines in the diagram show which pressure the pipe can resist at a certain age and a constant water temperature.
It is clear that the pipe can withstand less pressure as it becomes older. To obtain German DVGW certification, after 50 years and a constant water temperature of 70°C a pipe must be able to withstand a pressure 1.5 times greater than the working pressure. A regression curve is diameter-dependent.

The regression curves for the different diameters of the Henco multilayer pipe show that with any diameter, after 50 years with a water temperature of 70°C,
a pressure can be resisted that is much higher than that required for DVGW certification. The Henco pipe has a working life of at least 50 years.
An example is shown below of the regression curve for diameter 16, as drawn up by the test laboratory of the SKZ in Germany.


SKZ

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10.2 Zeitstand-Innendruckdiagramm Verbundrohr PE-Xc/Al/PE-Xc,
Dimension Ø 16 x 2 mm

Zeitstand-Innendruckverhalten

Prüfdruck in bar

100

10

1

0,1 1 10 100 1000 10000 100000 1000000

Standzeit in Stunden

SKZ

1.3 Henco pre-insulated multilayer pipe

The manufacturer provides the PE-Xc/Al/PE-Xc pipes with a round or eccentric thermal insulating material. The extruded PE foam protects the pipe against

- condensation
- heat loss
- expansion
- noise transmission.

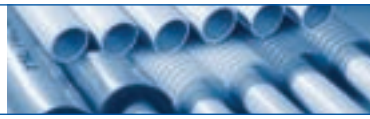
Furthermore, pipes should be protected where they are grouped at high temperatures (floor heating effect).

PE-foam has an extruded PE-film coloured red or blue. The insulating material is CFC-free and has the following characteristics:

Quality standard	UNI and ISO 9002-94
Lambda value	0.040 W/mK at + 40°C
Fire class	1 - UNI 9177 and UNI 8457
Temperature resistance	-35°C to + 95°C
Thickness (round)	6, 10 or 13 mm
Thickness (eccentric)	6 mm above and 13 or 26 mm below

PE-Xc /AL / PE-Xc
100% QUALITY

Types and dimensions of pre-insulated pipes: see delivery range on page 83.



Transmission table

	Ø14		Ø16			Ø18		Ø20			Ø26			Ø32	
ΔT	6 mm	10 mm	6 mm	10 mm	13 mm	6 mm	10 mm	6 mm	10 mm	13 mm	6 mm	10 mm	13 mm	6 mm	10 mm
0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
-1,0	-0,4	-0,4	-0,4	-0,4	-0,3	-0,4	-0,3	-0,3	-0,3	-0,3	-0,3	-0,2	-0,2	-0,2	-0,2
-2,0	-0,9	-0,8	-0,8	-0,7	-0,7	-0,7	-0,7	-0,7	-0,6	-0,6	-0,5	-0,5	-0,5	-0,4	-0,4
-3,0	-1,3	-1,2	-1,2	-1,1	-1,0	-1,1	-1,0	-1,0	-0,9	-0,9	-0,8	-0,7	-0,7	-0,6	-0,6
-4,0	-1,8	-1,6	-1,6	-1,4	-1,3	-1,4	-1,3	-1,3	-1,2	-1,1	-0,1	-0,1	-0,9	-0,9	-0,8
-5,0	-2,2	-2,0	-2,0	-1,8	-1,7	-1,8	-1,6	-1,6	-1,5	-1,4	-1,3	-1,2	-1,2	-1,1	-1,0
-6,0	-2,7	-2,4	-2,4	-2,2	-2,0	-2,1	-2,0	-2,0	-1,8	-1,7	-1,6	-1,5	-1,4	-1,3	-1,2
-7,0	-3,1	-2,8	-2,8	-2,5	-2,4	-2,5	-2,3	-2,3	-2,1	-2,0	-1,8	-1,7	-1,6	-1,5	-1,4
-8,0	-3,5	-3,2	-3,2	-2,9	-2,7	-2,9	-2,6	-2,6	-2,4	-2,3	-2,1	-1,9	-1,9	-1,7	-1,6
-9,0	-4,0	-3,6	-3,6	-3,2	-3,0	-3,2	-2,9	-2,9	-2,7	-2,6	-2,3	-2,2	-2,1	-1,9	-1,8
-10,0	-4,4	-4,0	-4,0	-3,6	-3,4	-3,6	-3,3	-3,3	-3,0	-2,8	-2,6	-2,4	-2,3	-2,2	-2,0
-11,0	-4,9	-4,4	-4,4	-3,9	-3,7	-3,9	-3,6	-3,6	-3,3	-3,1	-2,9	-2,7	-2,5	-2,4	-2,2
-12,0	-5,3	-4,8	-4,8	-4,3	-4,0	-4,3	-3,9	-3,9	-3,6	-3,4	-3,1	-2,9	-2,8	-2,6	-2,4
-13,0	-5,8	-5,2	-5,1	-4,7	-4,4	-4,7	-4,3	-4,3	-3,9	-3,7	-3,4	-3,2	-3,0	-2,8	-2,6
-14,0	-6,2	-5,6	-5,5	-5,0	-4,7	-5,0	-4,6	-4,6	-4,2	-4,0	-3,6	-3,4	-3,2	-3,0	-2,8
-15,0	-6,6	-6,0	-5,9	-5,4	-5,0	-5,4	-4,9	-4,9	-4,5	-4,3	-3,9	-3,6	-3,5	-3,2	-3,1
-16,0	-7,1	-6,4	-6,3	-5,7	-5,4	-5,7	-5,2	-5,2	-4,8	-4,6	-4,2	-3,9	-3,7	-3,4	-3,3
-17,0	-7,5	-6,8	-6,7	-6,1	-5,7	-6,1	-5,6	-5,6	-5,1	-4,8	-4,4	-4,1	-3,9	-3,7	-3,5
-18,0	-8,0	-7,1	-7,1	-6,5	-6,0	-6,4	-5,9	-5,9	-5,4	-5,1	-4,7	-4,4	-4,2	-3,9	-3,7
-19,0	-8,4	-7,5	-7,5	-6,8	-6,4	-6,8	-6,2	-6,2	-5,7	-5,4	-4,9	-4,6	-4,4	-4,1	-3,9
-20,0	-8,8	-7,9	-7,9	-7,2	-6,7	-7,2	-6,5	-6,5	-6,0	-5,7	-5,2	-4,9	-4,6	-4,3	-4,1
-21,0	-9,3	-8,3	-8,3	-7,5	-7,1	-7,5	-6,9	-6,9	-6,3	-6,0	-5,5	-5,1	-4,9	-4,5	-4,3
-22,0	-9,7	-8,7	-8,7	-7,9	-7,4	-7,9	-7,2	-7,2	-6,6	-6,3	-5,7	-5,3	-5,1	-4,7	-4,5

The table shows the surface temperature of the insulation at a certain temperature difference.

Example: - ambient temperature: 24°C
- cooling water temperature: 6°C
- temperature difference: 6°C - 24°C= -18°C

A 16 mm pipe provided with 10 mm insulation gives with a temperature difference of -18°C a correction value of -6.5°C.

The surface temperature then amounts to 17.5°C (24°C - 6.5°C).

To avoid condensation, the surface temperature of the insulation must always be higher than the dew point temperature.

1.4 Henco multilayer pipes with protective sleeve

PE-Xc/Al/PE-Xc piping running through floors, walls or ceilings should always be protected with a sleeve. Also, it is advisable to protect the pipes after assembly against damages caused by other work being done on the site.

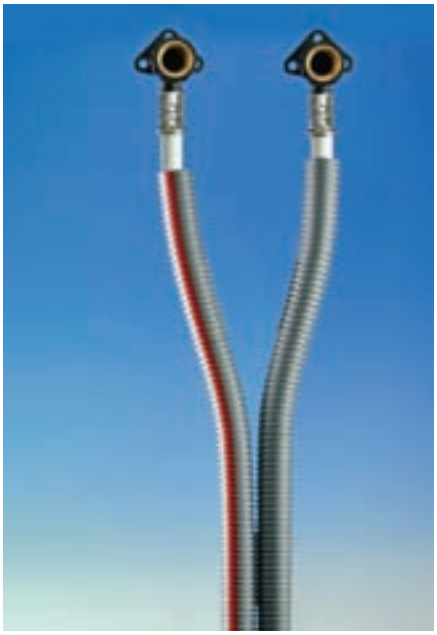
The protective sleeve in red, blue, yellow or black is made of polyethylene and is as pipe in pipe or seperately available.

PE-Xc /AL / PE-Xc
100% QUALITY

For types and dimensions of pipes with a protective sleeve: see page 84.

1.5 HENCO COMBI®

The HENCO COMBI® consists of two Henco PE-Xc/AL/PE-Xc pipes, with two polyethylene sleeves connected by means of a perforated strip. All on one coil, the inserts keep all elements together and ensure a perfectly finished installation. In addition, the perforated connections allow separation of the sleeves where necessary. To distinguish the contents of the sleeve pipes, one of the two silver-grey sleeves is marked with a red line.



The gamut in the delivery program on page 84.

1 PIPES

Dura, years 1956-1970

1.6 Henco multilayer pipe for gas

1.6.1 General

The Henco system for gas is only allowed in countries where testing has taken place and a corresponding certificate is available, such as in the Netherlands and Australia.

The system has Kiwa gas approval and is intended for the construction of gas installations within the home and for the transportation of gas according to NPR-3378-10/NEN 1078 part 10.

The system consists of Henco PE-Xc/AL/PE-XC multilayer pipes, Henco PVDF press fittings for gas and Henco protective sleeves. The pipes and sleeves have a yellow colour with imprint of the brand name and KIWA gas approval. The fittings are also provided on each pressure sleeve with a yellow strip mentioning the brand name and KIWAGAS. This mark ensures that the synthetic fittings for sanitary and heating appliances are not used for gas applications and vice versa. The fittings for gas are provided with specific O-rings!

To protect the pipe against damage where it passes through structures and the whole installation during assembly, it is recommended to make use of pipes with protective sleeve. Pipe sleeves for gas only are yellow in colour. The pipe sleeve is made of polyethylene and can also be supplied seperatly.

kiwa
Partner for progress

Certified Product™
Australian Standard

The range is shown on page 85.

1.6.2 Instructions for the installation of gas piping (NPR 3378-10 NL)

- The piping route must be selected so the likelihood of damage by, for example, drilling or nailing is as low as possible.
- In bends one must respect the minimum bending radius as specified by the manufacturer. Folded piping must be avoided.
- In walls the depth of the opening must be such that the shortest distance of the pipe to the external side of the wall is at least 10 mm.
- With piping in floors the shortest distance from the pipe to the external side of the floor must be at least 20 mm.
- During construction activities the gas pipe must be blocked off so no dirt or dust can enter the pipe. If dirt has arrived in the pipe the pipe must be cleaned with an inert gas or air..
- Pipes and connections showing signs of surface damage may not be used..
- A pipe sleeve must be used when a pipe passes through a (cavity) wall. The shortest route must be chosen..
- Piping may not be laid in a cavity wall.

The table below shows a diagrammatical summary of where pipes may or may not be laid.

Location	Allowed?	Restrictions	Note
A. In view	No		
B. Accessibly concealed	Yes	Detachable fittings may not be used. Connections must at least be equivalent to a soldered joint.	No pipe sleeve required. A pipe in a pipe sleeve is regarded as accessible.
B1. Below ground floor (crawl space)	Yes	Intermediate connections are not allowed The pipe must be. provided with a pipe sleeve.	
C. In the ground	Yes	If below the home use a pipe sleeve.	Intermediate connections are not allowed.
D. Concealed in floor wall or inaccessible space	Yes	Detachable fittings may not be used. Connections must at least be equivalent to a soldered joint.	

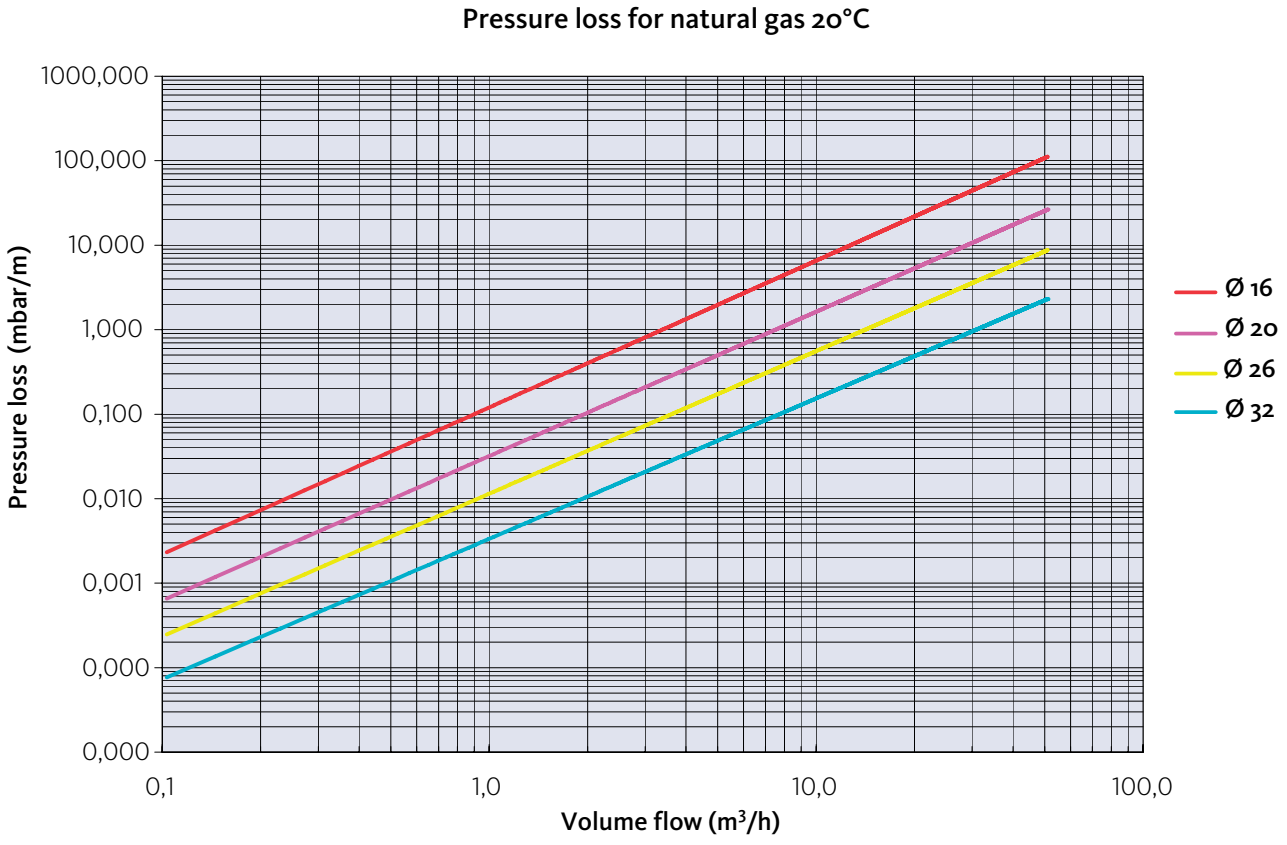
1.6.3 Pressure test

The strength of the pipe is first tested with a pressure surge of air at 1 bar (1000 mbar). The pressure is then lowered to a test pressure of 100 mbar above working pressure. The pipe is regarded as gastight if for 5 minutes no visible lowering of pressure occurs. The lowering of pressure is measured by means of a U-pipe manometer.

Note: These instructions only comprise a small part of the actual standard. For more details on these instructions please consult NPR 3378-10 (nl).

1.6.4 Pressure loss diagram and pressure loss table for gas pipes

Just like water, gas will also lose energy by the force of friction on the wall of the pipe. On the basis of the pressure loss diagram for gas a correct pipe calculation can be made. According to NEN 1078 the piping must be designed so that its pressure loss is no more than the difference between the working pressure and the minimum necessary consumption pressure according to the appliance manufacturer. This means for a household gas installation that the total pressure loss from the outlet of the gas meter to the appliance may be 250 Pa (2.5 mbar).



Henco multilayer pipe

Atmospheric pressure 1013
Gas temperature 12 °C

		Diameter 16			Diameter 20			Diameter 26			Diameter 32		
Capacity (KW)	Volume flow m³/h	Speed (m(n)/s)	Pressure loss (Pa/m)	Pressure loss (mbar/m)	Speed (m(n)/s)	Pressure loss (Pa/m)	Pressure loss (mbar/m)	Speed (m(n)/s)	Pressure loss (Pa/m)	Pressure loss (mbar/m)	Speed (m(n)/s)	Pressure loss (Pa/m)	Pressure loss (mbar/m)
1	0,10	0,25	0,7	0,007	0,14	0,2	0,002	0,09	0,1	0,001	0,05	0,0	0,000
2	0,20	0,50	1,3	0,013	0,28	0,4	0,004	0,18	0,2	0,002	0,11	0,1	0,001
3	0,31	0,75	2,0	0,020	0,42	0,6	0,006	0,27	0,3	0,003	0,16	0,1	0,001
4	0,41	1,01	2,6	0,026	0,57	0,8	0,008	0,36	0,3	0,003	0,21	0,1	0,001
5	0,51	1,26	3,3	0,033	0,71	1,0	0,010	0,45	0,4	0,004	0,27	0,1	0,001
6	0,61	1,51	4,0	0,040	0,85	1,3	0,013	0,54	0,5	0,005	0,32	0,2	0,002
7	0,72	1,76	4,6	0,046	0,99	1,5	0,015	0,63	0,6	0,006	0,38	0,2	0,002
8	0,82	2,01	5,3	0,053	1,13	1,7	0,017	0,72	0,7	0,007	0,43	0,2	0,002
9	0,92	2,26	5,9	0,059	1,27	1,9	0,019	0,81	0,8	0,008	0,48	0,3	0,003
10	1,02	2,52	10,9	0,109	1,41	2,1	0,021	0,91	0,9	0,009	0,54	0,3	0,003
11	1,13	2,77	12,8	0,128	1,56	2,3	0,023	1,00	0,9	0,009	0,59	0,3	0,003
12	1,23	3,02	14,9	0,149	1,70	2,5	0,025	1,09	1,0	0,010	0,64	0,4	0,004
13	1,33	3,27	17,0	0,170	1,84	4,4	0,044	1,18	1,1	0,011	0,70	0,4	0,004
14	1,43	3,52	19,3	0,193	1,98	5,0	0,050	1,27	1,2	0,012	0,75	0,4	0,004
15	1,54	3,77	21,7	0,217	2,12	5,6	0,056	1,36	1,3	0,013	0,80	0,4	0,004
16	1,64	4,02	24,3	0,243	2,26	6,2	0,062	1,45	1,4	0,014	0,86	0,5	0,005
17	1,74	4,28	26,9	0,269	2,41	6,9	0,069	1,54	2,4	0,024	0,91	0,5	0,005
18	1,84	4,53	29,7	0,297	2,55	7,6	0,076	1,63	2,7	0,027	0,96	0,5	0,005
19	1,94	4,78	32,6	0,326	2,69	8,4	0,084	1,72	2,9	0,029	1,02	0,6	0,006
20	2,05	5,03	35,6	0,356	2,83	9,1	0,091	1,81	3,2	0,032	1,07	0,6	0,006
21	2,15	5,28	38,7	0,387	2,97	9,9	0,099	1,90	3,5	0,035	1,13	0,9	0,009
22	2,25	5,53	41,9	0,419	3,11	10,7	0,107	1,99	3,7	0,037	1,18	1,0	0,010
23	2,35	6,19	45,3	0,453	3,25	11,6	0,116	2,08	4,0	0,040	1,23	1,1	0,011
24	2,46	6,04	48,8	0,488	3,40	12,5	0,125	2,17	4,3	0,043	1,29	1,2	0,012
25	2,56	6,29	52,3	0,523	3,54	13,4	0,134	2,26	4,7	0,047	1,34	1,3	0,013
26	2,66	6,54	56,0	0,560	3,68	14,3	0,143	2,35	5,0	0,050	1,39	1,3	0,013
27	2,76	6,79	59,8	0,598	3,82	15,3	0,153	2,44	5,3	0,053	1,45	1,4	0,014
28	2,87	7,04	63,7	0,637	3,96	16,2	0,162	2,54	5,7	0,057	1,50	1,5	0,015
29	2,97	7,29	67,7	0,677	4,10	17,3	0,173	2,63	6,0	0,060	1,55	1,6	0,016
30	3,07	7,55	71,8	0,718	4,24	18,3	0,183	2,72	6,4	0,064	1,61	1,7	0,017
31	3,17	7,80	76,1	0,761	4,39	19,4	0,194	2,81	6,7	0,067	1,66	1,8	0,018
32	3,28	8,05	80,4	0,804	4,53	20,4	0,204	2,90	7,1	0,071	1,71	1,9	0,019
33	3,38	8,30	84,8	0,848	4,67	21,6	0,216	2,99	7,5	0,075	1,77	2,0	0,020
34	3,48	8,55	89,4	0,894	4,81	22,7	0,227	3,08	7,9	0,079	1,82	2,1	0,021
35	3,58	8,80	94,0	0,940	4,95	23,9	0,239	3,17	8,3	0,083	1,88	2,2	0,022
36	3,68	9,06	98,8	0,988	5,09	25,1	0,251	3,26	8,7	0,087	1,93	2,3	0,023
37	3,79	9,31	103,6	1,036	5,24	26,3	0,263	3,35	9,1	0,091	1,98	2,5	0,025
38	3,89	9,56	108,6	1,086	5,38	27,5	0,275	3,44	9,5	0,095	2,04	2,6	0,026
39	3,99	9,81	113,7	1,137	5,52	28,8	0,288	3,53	10,0	0,100	2,09	2,7	0,027
40	4,09	10,06	118,8	1,188	5,66	30,1	0,301	3,62	10,4	0,104	2,14	2,8	0,028
41	4,20	10,31	124,1	1,241	5,80	31,4	0,314	3,71	10,9	0,109	2,20	2,9	0,029
42	4,30	10,56	129,5	1,295	5,94	32,8	0,328	3,80	11,3	0,113	2,25	3,1	0,031
43	4,40	10,82	134,9	1,349	6,08	34,1	0,341	3,89	11,8	0,118	2,30	3,2	0,032
44	4,50	11,07	140,5	1,405	6,23	35,5	0,355	3,98	12,3	0,123	2,36	3,3	0,033
45	4,61	11,32	146,2	1,462	6,37	36,9	0,369	4,07	12,8	0,128	2,41	3,4	0,034
46	4,71	11,57	152,0	1,520	6,51	38,4	0,384	4,17	13,3	0,133	2,46	3,6	0,036
47	4,81	11,82	157,8	1,578	6,65	39,8	0,398	4,26	13,8	0,138	2,52	3,7	0,037
48	4,91	12,07	163,8	1,638	6,79	41,3	0,413	4,35	14,3	0,143	2,57	3,8	0,038
49	5,02	12,33	169,9	1,699	6,93	42,9	0,429	4,44	14,8	0,148	2,63	4,0	0,040
50	5,12	12,58	176,1	1,761	7,07	44,4	0,444	4,53	15,3	0,153	2,68	4,1	0,041

Henco multilayer pipe

Atmospheric pressure 1013
Gas temperature 12 °C

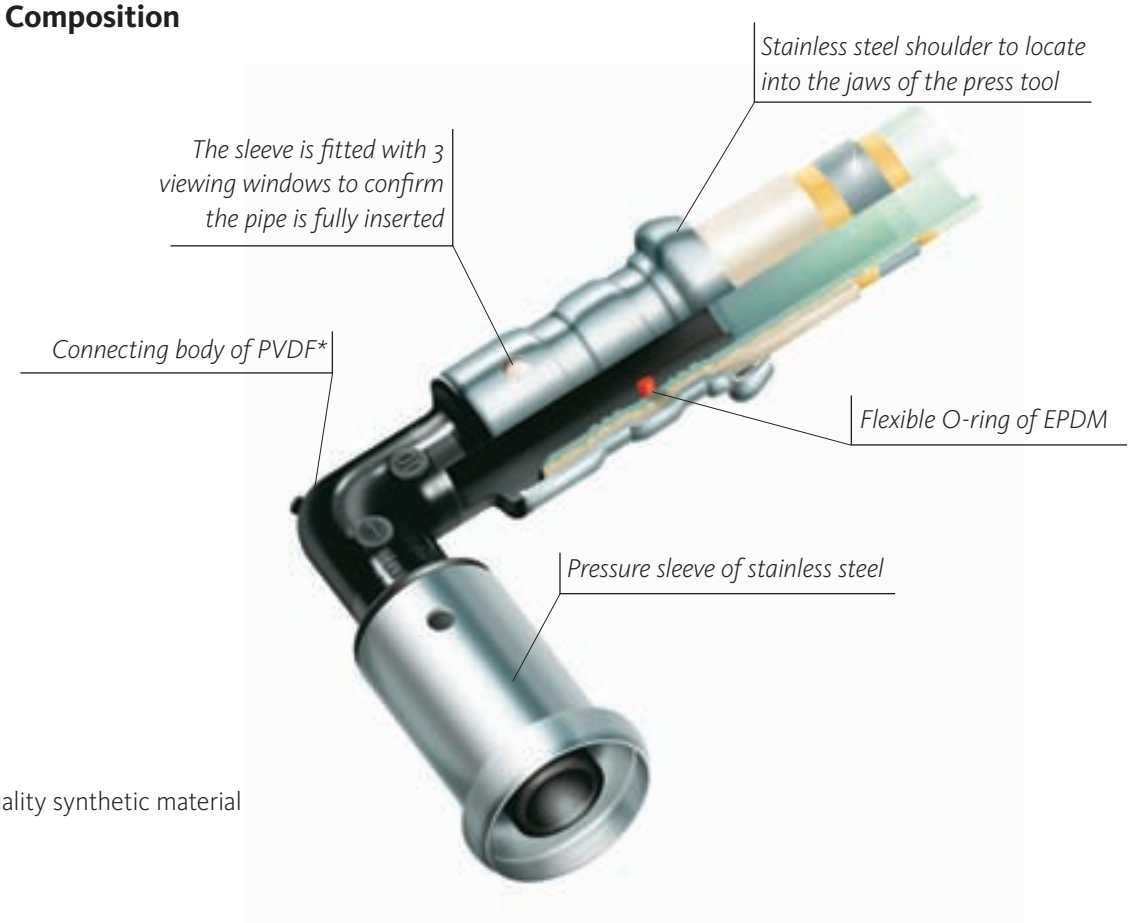
Capacity	Volume flow	Diameter 16			Diameter 20			Diameter 26			Diameter 32		
		Speed	Pressure loss	Pressure loss	Speed	Pressure loss	Pressure loss	Speed	Pressure loss	Pressure loss	Speed	Pressure loss	Pressure loss
(KW)	m³/h	(m(n)/s)	(Pa/m)	(mbar/m)	(m(n)/s)	(Pa/m)	(mbar/m)	(m(n)/s)	(Pa/m)	(mbar/m)	(m(n)/s)	(Pa/m)	(mbar/m)
51	5,22	12,83	182,34	1,823	7,22	45,96	0,460	4,62	15,88	0,159	2,73	4,28	0,043
52	5,32	13,08	188,72	1,887	7,36	47,54	0,475	4,71	16,42	0,164	2,79	4,42	0,044
53	5,43	13,33	195,19	1,952	7,50	49,16	0,492	4,80	16,97	0,170	2,84	4,57	0,046
54	5,53	13,58	201,76	2,018	7,64	50,79	0,508	4,89	17,53	0,175	2,89	4,72	0,047
55	5,63	13,83	208,42	2,084	7,78	52,45	0,524	4,98	18,10	0,181	2,95	4,88	0,049
56	5,73	14,09	215,19	2,152	7,92	54,13	0,541	5,07	18,68	0,187	3,00	5,03	0,050
57	5,83	14,34	222,05	2,221	8,06	55,84	0,558	5,16	19,26	0,193	3,05	5,19	0,052
58	5,94	14,59	229,01	2,290	8,21	57,57	0,576	5,25	19,85	0,199	3,11	5,35	0,053
59	6,04	14,84	236,07	2,361	8,35	59,32	0,593	5,34	20,45	0,205	3,16	5,51	0,055
60	6,14	15,09	243,22	2,432	8,49	61,10	0,611	5,43	21,06	0,211	3,21	5,67	0,057
61	6,24	15,34	250,48	2,505	8,63	62,90	0,629	5,52	21,68	0,217	3,27	5,84	0,058
62	6,35	15,60	257,82	2,578	8,77	64,72	0,647	5,61	22,30	0,223	3,32	6,01	0,060
63	6,45	15,85	265,27	2,653	8,91	66,56	0,666	5,70	22,93	0,229	3,38	6,18	0,062
64	6,55	16,10	272,81	2,728	9,06	68,43	0,684	5,80	23,57	0,236	3,43	6,35	0,063
65	6,65	16,35	280,44	2,804	9,20	70,33	0,703	5,89	24,22	0,242	3,48	6,52	0,065
66	6,76	16,60	288,18	2,882	9,34	72,24	0,722	5,98	24,87	0,249	3,54	6,70	0,067
67	6,86	16,85	296,00	2,960	9,48	74,18	0,742	6,07	25,53	0,255	3,59	6,88	0,069
68	6,96	17,10	303,93	3,039	9,62	76,14	0,761	6,16	26,20	0,262	3,64	7,06	0,071
69	7,06	17,36	311,95	3,119	9,76	78,12	0,781	6,25	26,88	0,269	3,70	7,24	0,072
70	7,17	17,61	320,06	3,201	9,90	80,13	0,801	6,34	27,56	0,276	3,75	7,42	0,074
71	7,27	17,86	328,27	3,283	10,05	82,16	0,822	6,43	28,26	0,283	3,80	7,61	0,076
72	7,37	18,11	336,57	3,366	10,19	84,21	0,842	6,52	28,96	0,290	3,86	7,80	0,078
73	7,47	18,36	344,97	3,450	10,33	86,29	0,863	6,61	29,66	0,297	3,91	7,99	0,080
74	7,57	18,61	353,46	3,535	10,47	88,38	0,884	6,70	30,38	0,304	3,96	8,18	0,082
75	7,68	18,86	362,05	3,620	10,61	90,50	0,905	6,79	31,10	0,311	4,02	8,38	0,084
76	7,78	19,12	370,73	3,707	10,75	92,65	0,926	6,88	31,83	0,318	4,07	8,57	0,086
77	7,88	19,37	379,50	3,795	10,89	94,81	0,948	6,97	32,57	0,326	4,13	8,77	0,088
78	7,98	19,62	388,37	3,884	11,04	97,00	0,970	7,06	33,31	0,333	4,18	8,97	0,090
79	8,09	19,87	397,34	3,973	11,18	99,21	0,992	7,15	34,07	0,341	4,23	9,18	0,092
80	8,19	20,12	406,39	4,064	11,32	101,44	1,014	7,24	34,83	0,348	4,29	9,38	0,094
81	8,29	20,37	415,54	4,155	11,46	103,70	1,037	7,33	35,59	0,356	4,34	9,59	0,096
82	8,39	20,63	424,79	4,248	11,60	105,97	1,060	7,43	36,37	0,364	4,39	9,80	0,098
83	8,50	20,88	434,12	4,341	11,74	108,27	1,083	7,52	37,15	0,372	4,45	10,01	0,100
84	8,60	21,13	443,55	4,436	11,88	110,59	1,106	7,61	37,94	0,379	4,50	10,22	0,102
85	8,70	21,38	453,08	4,531	12,03	112,94	1,129	7,70	38,74	0,387	4,55	10,43	0,104
86	8,80	21,63	462,69	4,627	12,17	115,30	1,153	7,79	39,54	0,395	4,61	10,65	0,107
87	8,91	21,88	472,40	4,724	12,31	117,69	1,177	7,88	40,36	0,404	4,66	10,87	0,109
88	9,01	22,13	482,20	4,822	12,45	120,10	1,201	7,97	41,17	0,412	4,72	11,09	0,111
89	9,11	22,39	492,10	4,921	12,59	122,53	1,225	8,06	42,00	0,420	4,77	11,31	0,113
90	9,21	22,64	502,09	5,021	12,73	124,98	1,250	8,15	42,84	0,428	4,82	11,54	0,115
91	9,31	22,89	512,17	5,122	12,88	127,46	1,275	8,24	43,68	0,437	4,88	11,76	0,118
92	9,42	23,14	522,34	5,223	13,02	129,96	1,300	8,33	44,52	0,445	4,93	11,99	0,120
93	9,52	23,39	532,60	5,326	13,16	132,48	1,325	8,42	45,38	0,454	4,98	12,22	0,122
94	9,62	23,64	542,96	5,430	13,30	135,02	1,350	8,51	46,24	0,462	5,04	12,45	0,125
95	9,72	23,90	553,41	5,534	13,44	137,58	1,376	8,60	47,11	0,471	5,09	12,69	0,127
96	9,83	24,15	563,95	5,639	13,58	140,17	1,402	8,69	47,99	0,480	5,14	12,93	0,129
97	9,93	24,40	574,58	5,746	13,72	142,77	1,428	8,78	48,88	0,489	5,20	13,16	0,132
98	10,03	24,65	585,30	5,853	13,87	145,40	1,454	8,87	49,77	0,498	5,25	13,40	0,134
99	10,13	24,90	596,12	5,961	14,01	148,05	1,481	8,96	50,67	0,507	5,30	13,65	0,136
100	10,24	25,15	607,02	6,070	14,15	150,72	1,507	9,06	51,57	0,516	5,36	13,89	0,139

PE-Xc /AL / PE-Xc
100% QUALITY

PRESS FITTINGS

2.1 Press fittings in synthetic material (PVDF)

2.1.1 Composition



*High quality synthetic material

The synthetic press fittings are made by injection moulding PVDF (Polyvinylidene fluoride)*. PVDF offers the user a unique combination of properties:

- excellent mechanical strength and hardness
- high wear-resistance
- enormous flexibility: up to 10° bending possible
- exceptional resistance to thermal aging
- extremely resistant to extreme temperatures: from -40°C to +150°C
- high purity
- no water absorption
- excellent chemical resistance to most aggressive substances and solvents
- physiologically harmless, approved for contact with food products, drinking water and the medical sector

PVDF is a synthetic material used for numerous applications in our society, and has already proved its qualities for more than 30 years in different fields. The three fields in which we most find PVDF are:

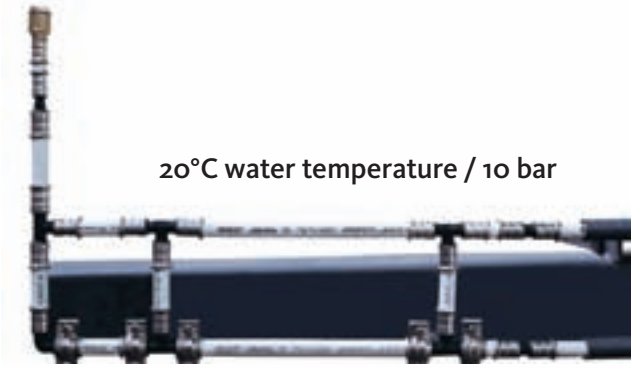
- the chemical industry (because of its good chemical resistance and thermomechanical properties)
- the cable industry (because of its fire-resistance and low smoke emission)
- the food industry (because of its purity and surface quality).

PVDF also lacks certain properties characteristic of copper, metal or brass systems. PVDF is corrosion-resistant. The extremely smooth wall makes the fitting enormously resistant to deposits. In addition, PVDF makes less noise and no potential contamination of the water is possible. Finally, PVDF is not only lighter, it is also less expensive than traditional metal fittings.

2.1.2 Power and flexibility of the Henco synthetic fittings (PVDF

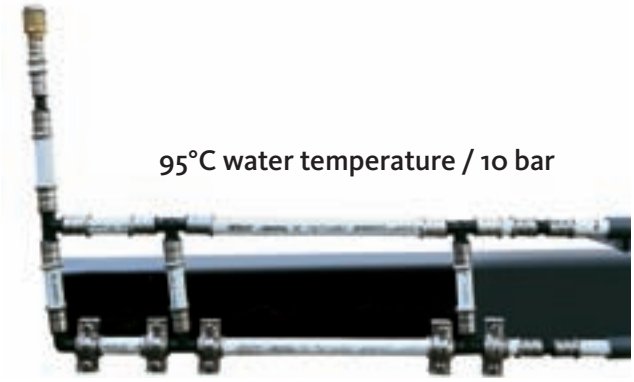
This test was carried out in the Henco laboratory. The brackets were deliberately fixed to the sleeves of the bottom fittings to make them a fixed point.

The first photograph shows us how the pipes and the fittings behave when water with a temperature of 20°C is flowing through. Nothing changes with the original test setup
.



20°C water temperature / 10 bar

The second photograph shows how the test setup responds when water at 95°C is pumped through the piping system. The setup leans in the direction of the flow. The T-pieces and the bend fitting accommodate the expansion forces. The test shows the force and flexibility of the Henco PVDF synthetic fitting.



95°C water temperature / 10 bar

2.1.3 Technical data

The most important PVDF data are:

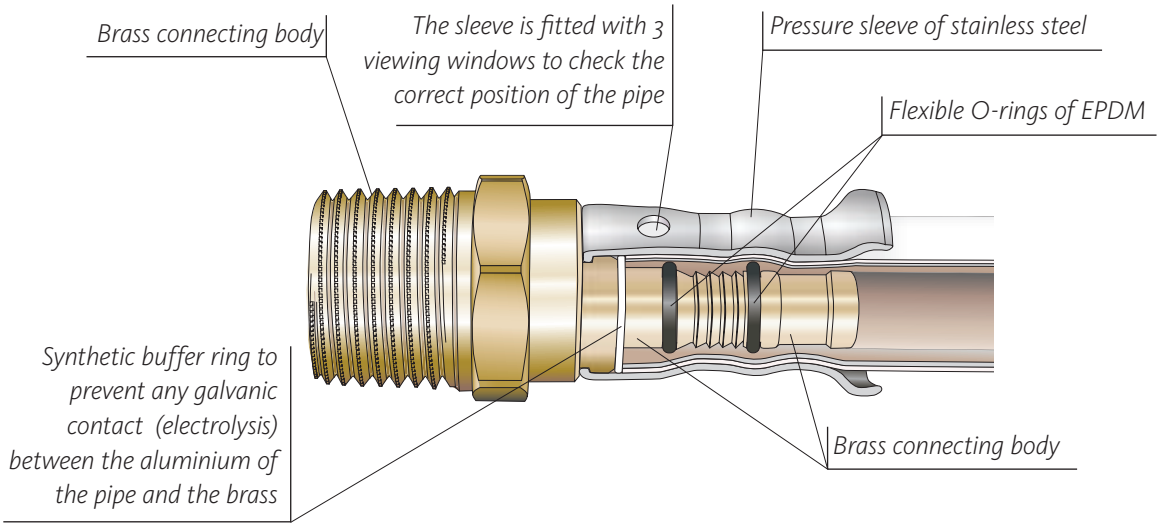
Density	g/cm3	1,78
Elongation limit	MPa	54
Tensile strength	MPa	46
Elongation at rupture	%	80
Modulus of elasticity	MPa	2400
Flexural strength	MPa	74
Flexural modulus	MPa	2300
Melting point	°C	174
Thermal conductance at 23°C	W/m.K	0,19
Thermal stability	°C	380

2.2 Synthetic (PVDF) press fittings for gas

From a technical perspective PVDF press fittings for gas have one important difference from the press fittings for sanitary and heating application.
The fittings are provided with a special O-ring that is resistant to gas. To make this difference visually clear they are provided with a yellow strip on each pressure sleeve. The fittings for gas may never be used for sanitary applications or heating. This also applies the other way around. Fittings for gas may only be used in combination with the yellow Henco multilayer pipe for gas. The system has Dutch Kiwa gas use approval.

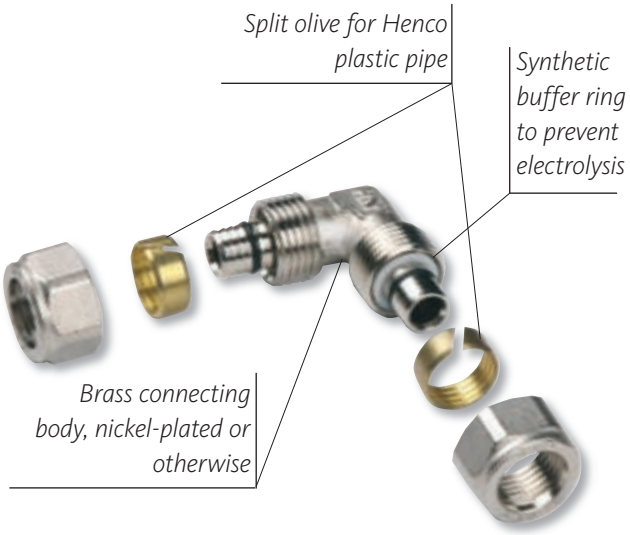
2.3 Brass press fittings

The connecting body in the fitting is made of brass.
As distinct from the PVDF fitting, the brass fitting must be provided with a synthetic buffer ring to prevent any galvanic contact between the aluminium of the pipe and the brass.
The fitting is also provided with O-rings of EPDM and a stainless steel sleeve with 3 viewing windows.

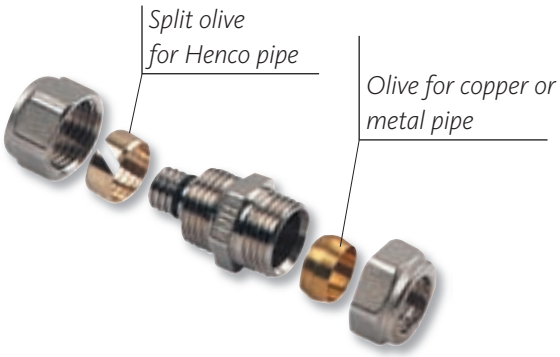


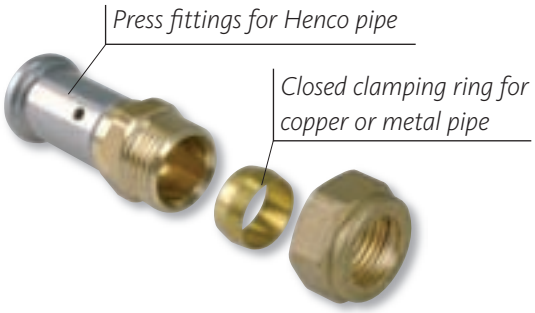
SCREW FITTINGS

The body of the Henco screw fittings is made of brass, and is nickel-plated or otherwise. They are provided with O-rings and a union nut, the clamping ring itself is not nickel-plated. Just like the brass press fittings they are fitted with a synthetic buffer ring to prevent electrolysis between the brass and aluminium.



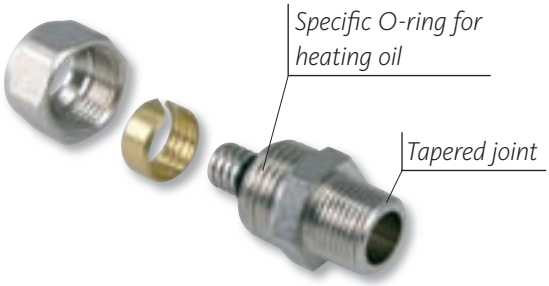
A comprehensive range of fittings are available for connecting Henco press and compression to copper or steel pipes.



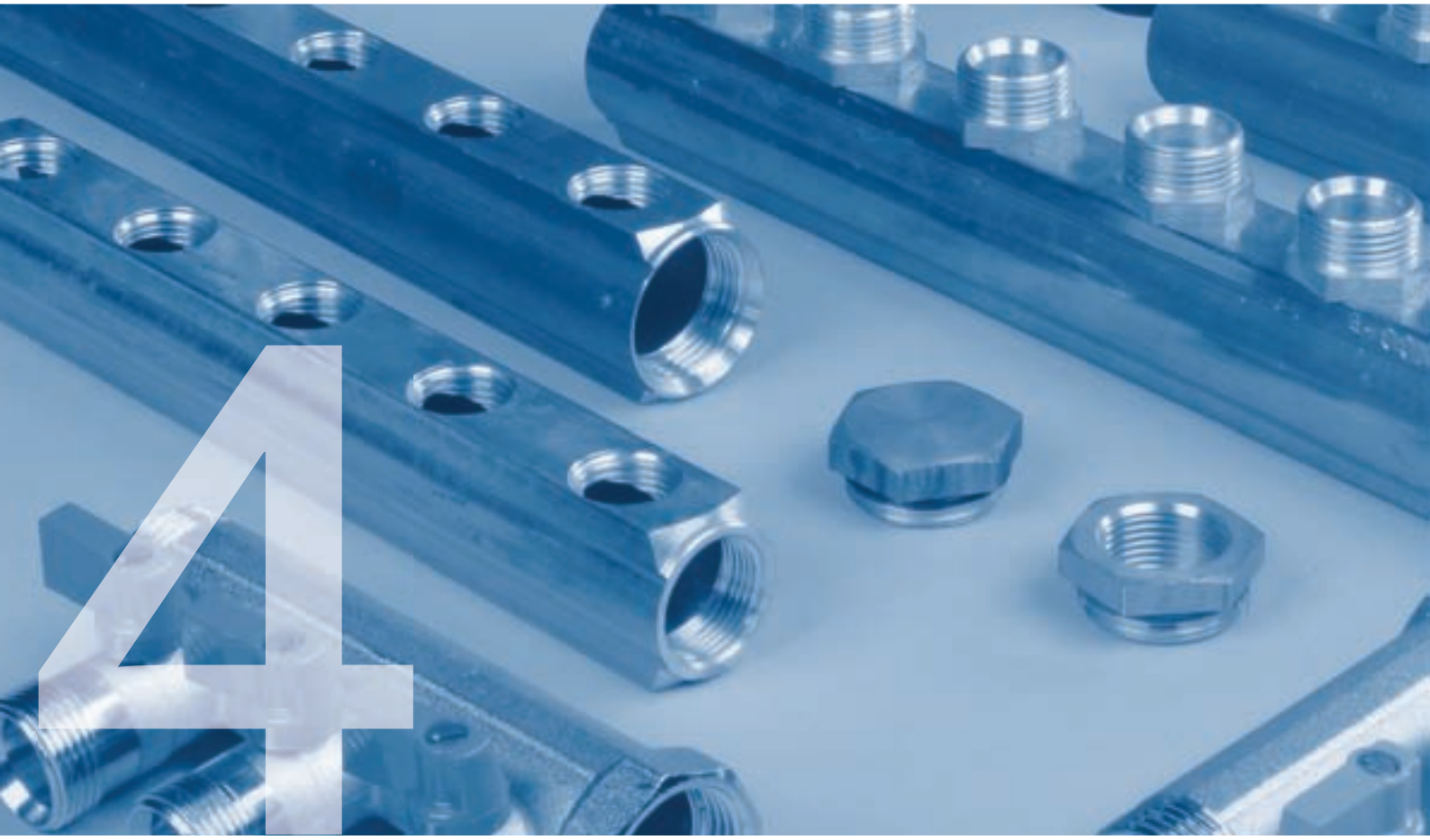


Henco also has a screw coupling for heating oil applications in its range.

The fitting has a tapered thread and is also provided with a specific O-ring for heating oil.



MANIFOLDS



Henco has manifolds for both sanitary and heating applications in its range.

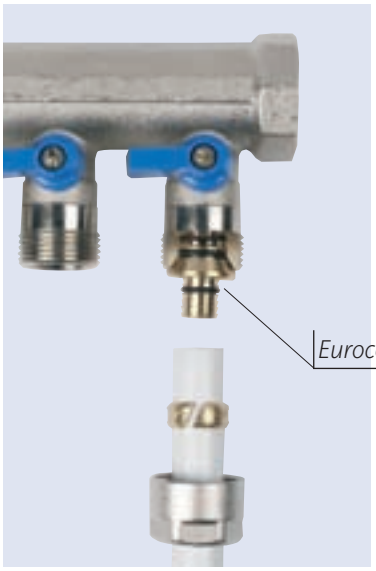
The manifolds are made of brass. They are available in 3/4", 1" or 5/4" versions, and are provided with 2 to 10 branches. The branches are fitted with 3/8", 1/2'" or euroconus connections.
They are available with a 3/8" screw thread for the fitting of an automatic air vent.

Henco also has manifolds made of brass in its range that are nickle plated. They are provided with ball valves and a euroconus connection on each outlet.

The manifolds are provided with 2, 3 or 4 connections. They are supplied with a female thread and the other end a 1" or 3/4" male thread to allow coupling together.

Only use blanking plug with "O"-ring

Euroconus connection



Euroconus connection

The range of manifolds available can be found on page 120.

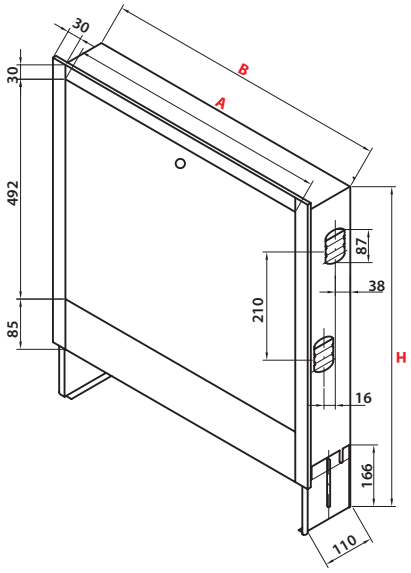
MANIFOLD CABINETS

Henco's built-in cabinets and surface mounted cabinets are made of sheet steel.
The built-in cabinets are galvanized or painted white (RAL 9016); the surface-mount type are painted white (RAL 9016).

Built-in cabinet	Type			
	VS-0204	VS-0208	VS-0912	VS-1316
Number of loops without pump unit; connected sideways	4	8	12	12
Number of loops without pump unit; connected downward	3	7	11	12
Number of loops with pump unit; connected sideways	x	4	8	12
Number of loops with pump unit; connected downward	x	3	7	11
Height of in-built (mm) *1 **H**	700-800	700-800	700-800	700-800
Width of in-built (mm) **B**	440	640	840	1040
Depth of in-built (mm) *2	112-152	112-152	112-152	112-152
Useful inner dimensions (mm)	390	590	790	990
Door opening (mm) **A**	390	590	790	990

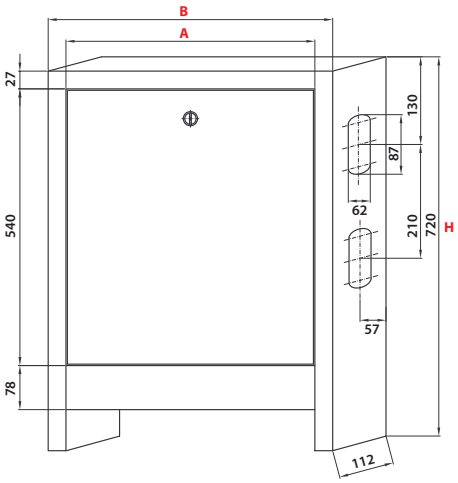
*1 Thanks to the adjustable feet the height of the built-in is adjustable between 700 and 800 mm.

*2 The casing is adjustable between 112 and 152 mm to make the cabinet fit the opening depth.



Opening needed	Type			
	VS-0204	VS-0208	VS-0912	VS-1316
Height (mm)	720-820	720-820	720-820	720-820
Width (mm)	490	690	890	1090
Depth (mm)	122-162	122-162	122-162	122-162

Wall cabinet	Type			
	VSA-0204	VSA-0208	VSA-0912	VSA-1316
Number of loops without pump unit; connected sideways	3	7	11	12
Number of loops without pump unit; connected downward	2	6	11	12
Number of loops with pump unit; connected sideways	x	3	7	11
Number of loops with pump unit; connected downward	x	2	6	10
Height (mm) **H**	720	720	720	720
Width (mm) **B**	400	600	800	1000
Depth (mm)	112	112	112	112
Useful inner dimensions (mm)	396	596	796	996
Door opening (mm) **A**	344	544	744	944



ASSEMBLY INSTRUCTIONS

6.1 General instructions for installing the pipe

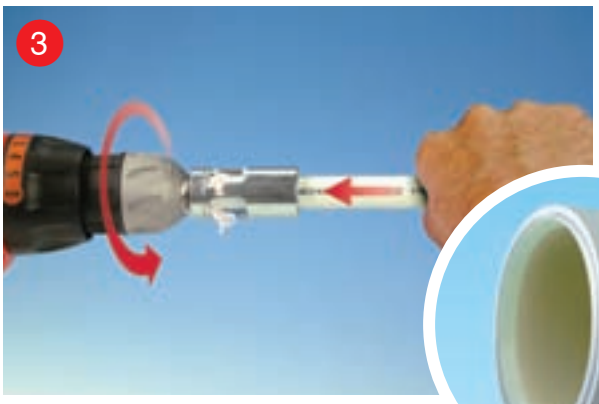
- The pipes must be transported and stored with care in the original manufacturer's packing.
- When opening the coils take care not to damage the pipe (do not use sharp objects).
- The unrolling of the coils must take place in the opposite direction to rolling up, so starting with the pipe end on the outside of the reel.
- Do not use any pieces with folds, kinks or damage.
- The pipes must always be laid without twists.
- The pipes must be protected against any distortion, soiling and/or damage.
- The pipes must be installed using Henco tools.
- The pipes must be **cut square**, and the ends of the pipe must always be **calibrated** and **deburred** according to the specified instructions.
- Pipe bends can be formed by hand, but to achieve bends with a minimum radius an internal or external bending spring must be used.
- If brass fittings are used, these must be provided with a synthetic ring at the end of the insert sleeve to prevent any electrolysis between the aluminium and the brass.
- The bare pipe may not come into contact with sharp objects during and after laying. For example, piping running through ceiling holes may not be bent around sharp edges as there is a danger of kinking.
- If further bending of the pipes are required after installation of fittings, it is reccomended that the pipe be retained by hand at the connection.
- After laying, the pipes must be protected against damage by other work taking place on the site. To ensure this the pipes best are provided with a protective sleeve or insulation available from the manufacturer.
- With building in, bare pipes may be used if insulated expansion bends are provided at least every 10 m. It is nevertheless advised to always provide the pipes with a sleeve or insulation from the manufacturer.
- When surface mounting, pipe brackets, expansion bends and expansion loops must be used as specified by the manufacturer.

6.2 Making a press connection

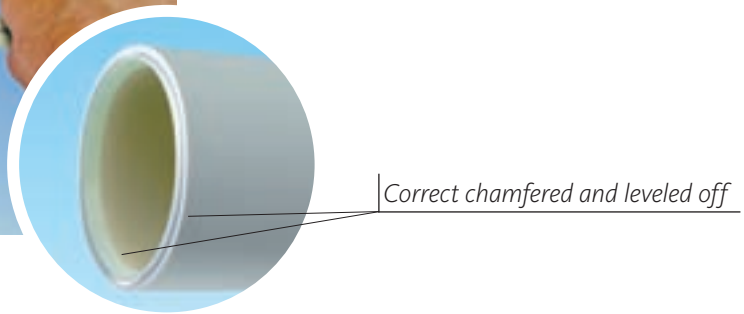
6.2.1 Step by step

When opening the coil never cut into the packing paper with a sharp object.

Always cut the pipe 90° square. For all diameters, and in particular Ø26 and greater, use of the RS32 or RS63 pipe cutter is recommended.



Calibrate the pipe with the Henco kalispeed. Slide the calibrator right into the pipe and then rotate it so that the cutter forms a continuous bevel to goth the inner and outer edge of the pipe. Remove all swarth.



Slide the calibrated pipe all the way into the press fitting so the pipe is visible through the windows.

Open the compression jaw and ensure that the shoulder of the fitting is located in the groove of the jaws. To ensure correct compression, operate the press tool until the jaws release automatically.

After the procedure is complete, open the compression jaws and check wether the pipe is still corectly mounted.

6.2.2 Pressing without stresses

It is very important not to apply stresses to the pipe installation during press-jointing. Pipes with fittings already pressed must also be kept free of stresses during further assembly.

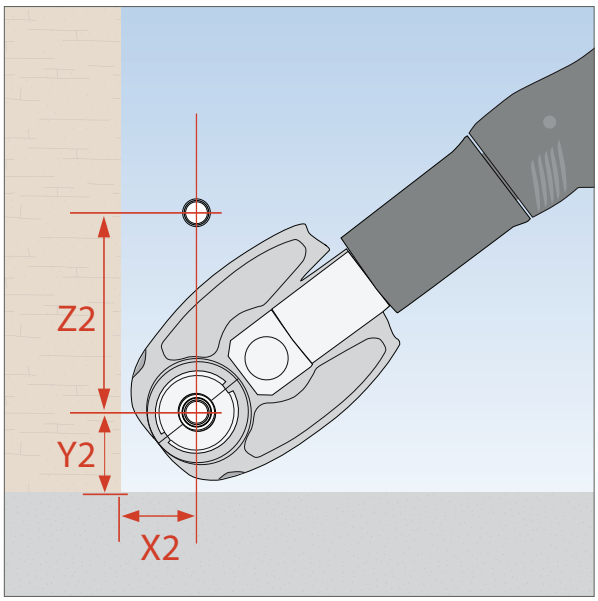
Once a fitting has been fitted to the pipe at one end using a press connection, the pipe may no longer cause any stresses on the fitting. If further bending is required, the pipe must be fully supported by hand and not the fitting.

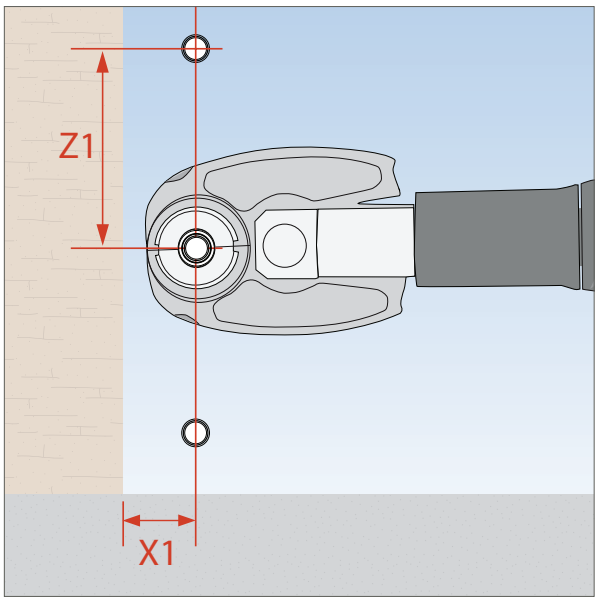
Installations with a press connection and a screwed connection, the screwed connection must first be made and then the press connection.

6.2.3 Required assembly space for the pressing jaw

Required assembly space for Henco pressing jaws (Type BE and BE-MINI*)									
	14x2	16x2	18x2	20x2	26x3	32x3	40x3,5	50x4,0	63x4,5
X1	30	30	30	30	35	35	50	55	90
Z1	65	65	65	65	70	75	110	115	120
X2	40	40	40	40	50	50	70	75	95
Y2	40	40	40	40	50	50	70	75	95
Z2	90	90	90	90	100	110	135	135	140

* BE-MINI tot Ø 32





6.2.4 Compatibility of Henco pressing jaws

Henco press fittings must be pressed by means of Henco BE-pressing jaws.
In addition to Henco's pressing tools there are several other pressing tools that are compatible with Henco BE-pressing jaws.

Pressing tools that are compatible with Henco BE-pressing jaws	
Brand	**Type**
Klauke	UAP2
	UNP2
	UP2EL-14
Novopress	EFP2
	ECO1
	ACO201
Viega	Typ 2
	PT2
	Akku Presshandy
Rems	Power Press ACC
	Akku Press
	Akku Press ACC
Roller	Multi-Press
	Multi Press ACC
	Uni Press ACC
Rothenberger	Romax Pressliner
	Vario Press 1000 APC
Ridgid	Press Fit Tool
Geberit	PWH 40
	PWH 75

Furthermore, all the pressing tools meeting the following requirements are allowed:

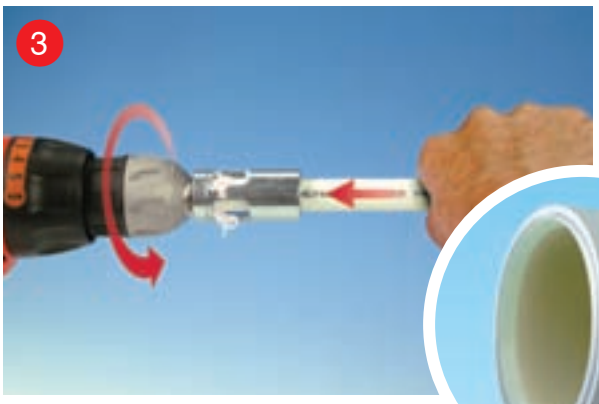
Thrust	Max. 38 KN
Diameter of locking bolts	15 mm
Lifting fork	40 mm
Electronic monitoring	none
Check closing of jaws	none

6.3 Making a screwed connection

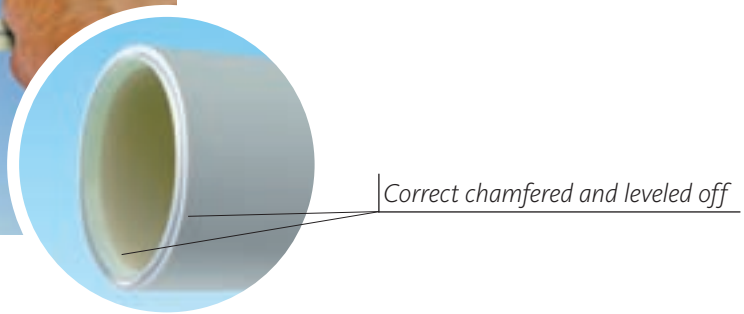
6.3.1 Step by step

When opening the coil never cut into the packing paper with a sharp object.

Always cut the pipe 90° square. For all diameters, and in particular Ø26 and greater, use of the RS32 or RS63 pipe cutter is recommended.



Calibrate the pipe with the Henco kalispeed. Slide the calibrator right into the pipe and then rotate it so that the cutter forms a continuous bevel to goth the inner and outer edge of the pipe. Remove all swarth.



Slide the nut and the split olive over the pipe.

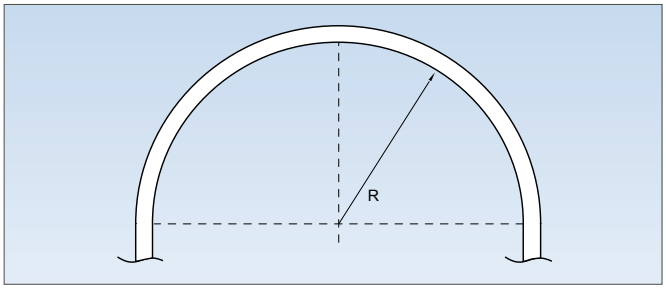
Insert the adaptor or socket in the pipe and push to the end. Make sure a synthetic ring is always fitted to prevent electrolysis. To facilitate sliding you can lubricate the nut with silicone oil. Do not use mineral oil!

Now turn the nut on the nipple, tap or collector until the force recommended by the manufacturer is reached. Always do this using two flat open jawed spanners.

Specified force for making a screw coupling		
Pipe type	Number of turns after tightening finger-tight	Corresponding turning torque in Nm
14x2	1	45
16x2	1	50
18x2	1	55
20x2	1	60
26x3	1/2	65

6.4 Bending Henco pipe

The Henco pipe must be bent without heat application. For pipes having a diameter larger than Ø 26 elbow fittings should be used. The pipes can be bent manually as well as with an internal or external spiral spring. The following bending radiuses are to be respected for pipes up to and including Ø 26 mm.



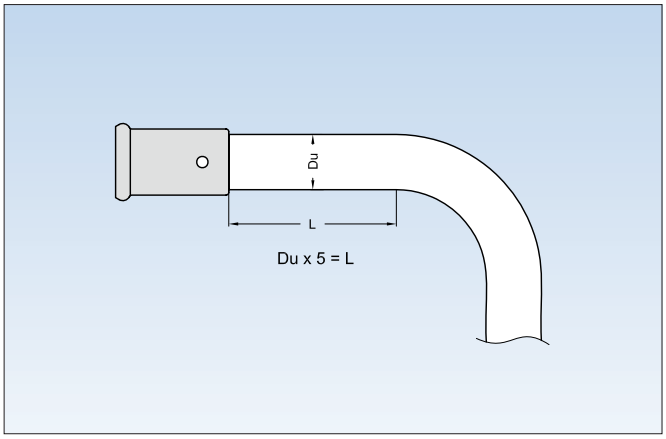
Pipe	Minimum bending radius manual/external spiral spring (mm)		Minimum bending radius internal spiral spring (mm)	
	Henco Standard	Henco RIXc	Henco Standard	Henco RIXc
14 x 2	R 70 (5xDu)		R 42 (3xDu)	
16 x 2	R 80 (5xDu)	R 128 (8xDu)	R 48 (3xDu)	R 128 (8xDu)
18 x 2	R 90 (5xDu)		R 54 (3xDu)	
20 x 2	R 100 (5xDu)	R 140 (7xDu)	R 60 (3xDu)	R 100 (5xDu)
26 x 3	R 130 (5xDu)	R 182 (7xDu)	R 78 (3xDu)	R 130 (5xDu)

Bending with external spiral spring

Bending with internal spiral spring

Bending manually

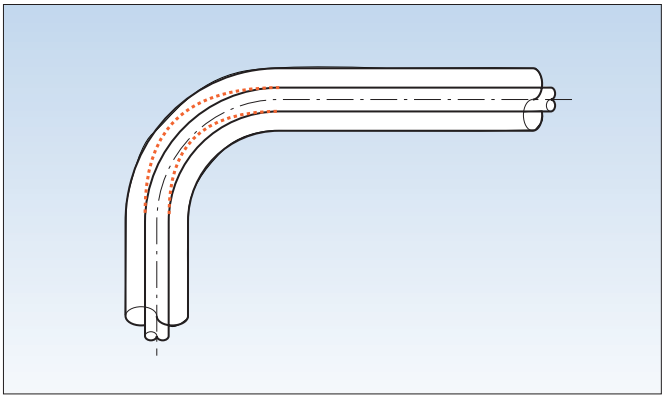
The bend should start at least 5 x the outer diameter off a fitting.
Never use cracked pipes!



6.5 Accommodation of expansion

6.5.1 With building in

To accommodate the expansion of the pipe within the structure, you must provide insulated expansion bends at least every 10 m. When this has been ensured, the pipe can be burried.

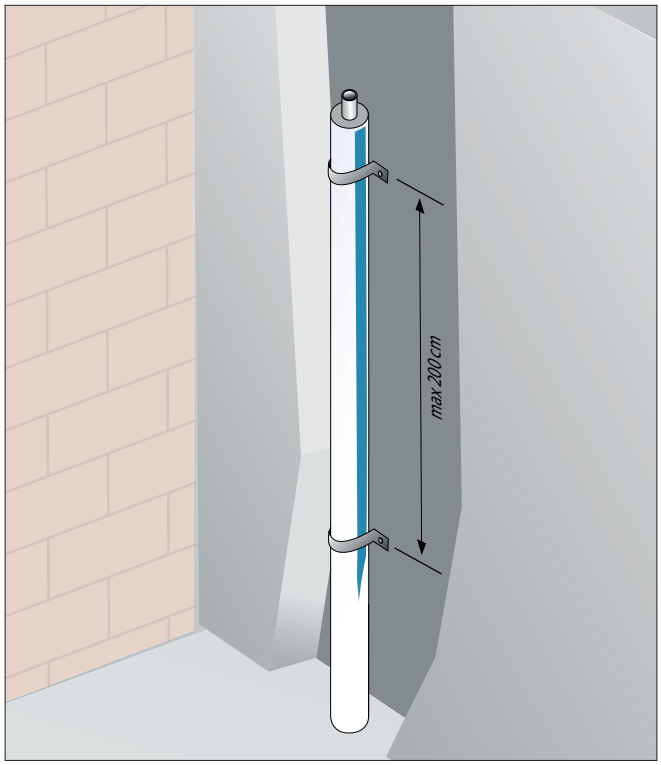


It's preferred to always provide the pipes with a protective sleeve, or better still insulation.
The sleeve has a protective function, while the insulation not only protects and thermally insulates the pipe, it also prevents the formation of condensation.

To determine the insulation thickness you can apply the following rule: 1.5 x ΔL (change in length).

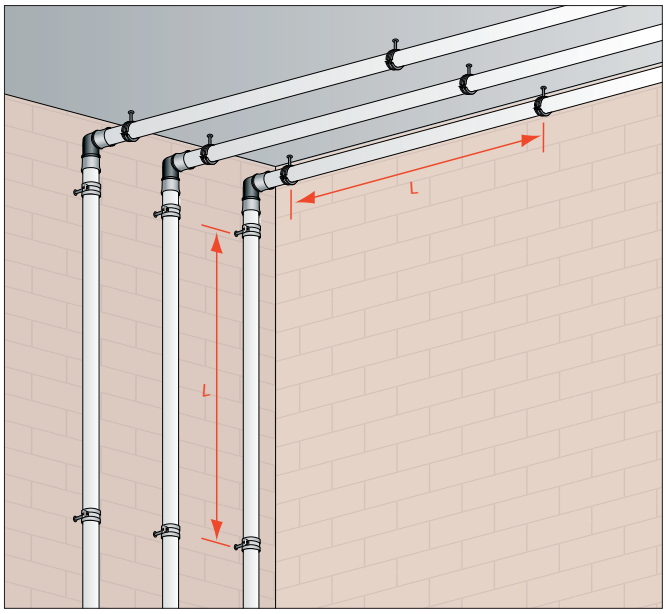
You must ensure that the distance between clips does not exceed 2 metres.

When Henco pipe is to be used for underfloor heating, these conditions do not apply.



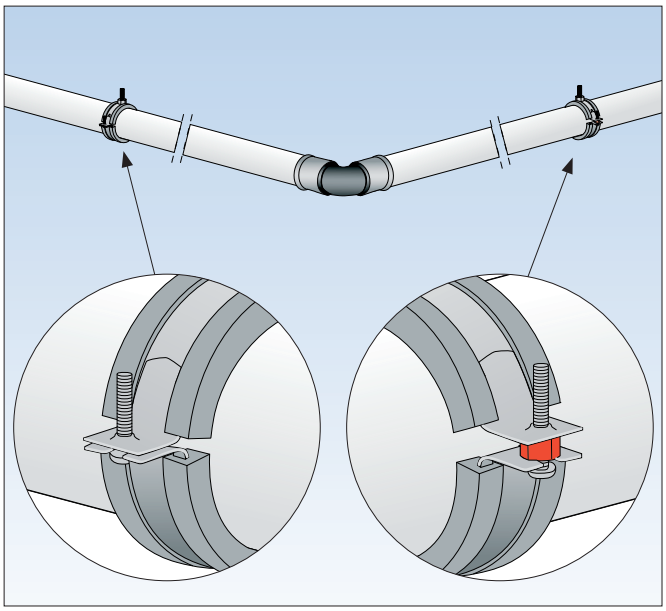
6.5.2 With surface mounting

For surface mounting, pipes are available in straight lenghts for the sake of convenience. Pipe brackets must be used when fixing Henco multilayer pipes to the **wall or ceiling**. The suspension brackets are synthetic or metal with a synthetic ring for the protection of the pipe. The specified maximum distance between the brackets must be adhered. The adjacent table gives an overview of the bracket distances to be kept.



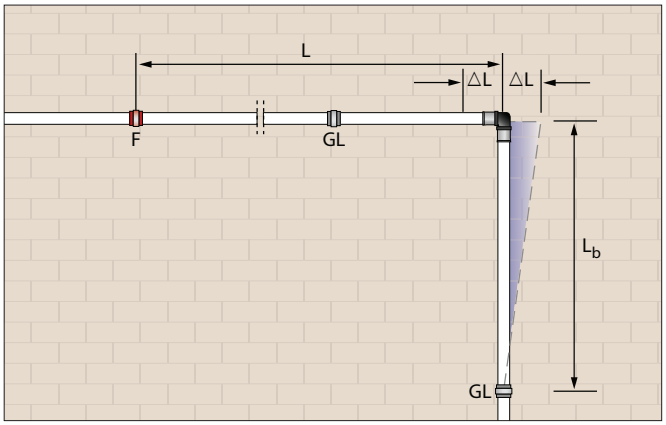
Pipe	Max. distance pipe brackets (cm))
14 x 2	80
16 x 2	80
18 x 2	100
20 x 2	120
26 x 3	150
32 x 3	160
40 x 3,5	170
50 x 4	180
63 x 4,5	200

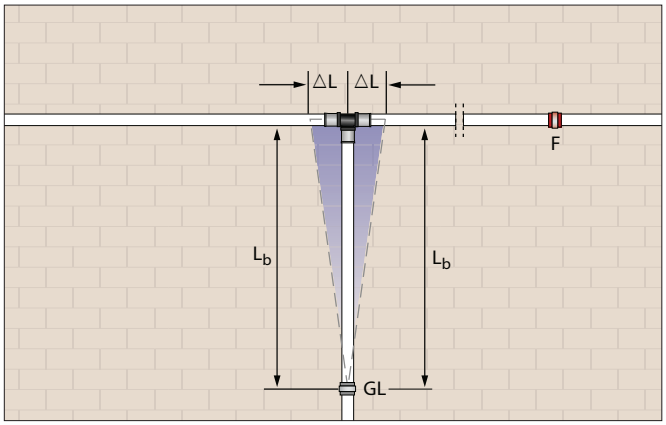
The **pipe brackets** have a twofold purpose; firstly they support the pipe network, and secondly they accommodate the thermal length changes of the pipe with **sliding and fixed points**, usually in combination with correctly calculated expansion bends and expansion loops. The sliding points must be such that the pipe continuously has clearance. The sliding point may not become a fixed point when the pipe expands.



The correct placing of sliding points and fixed points is very important when expansion bends and expansion loops are used. At all changes in direction expansion bends must be provided.

For making direction changes it is recommended to always use fittings. For pipes with a diameter of 32 mm or greater this is compulsory.



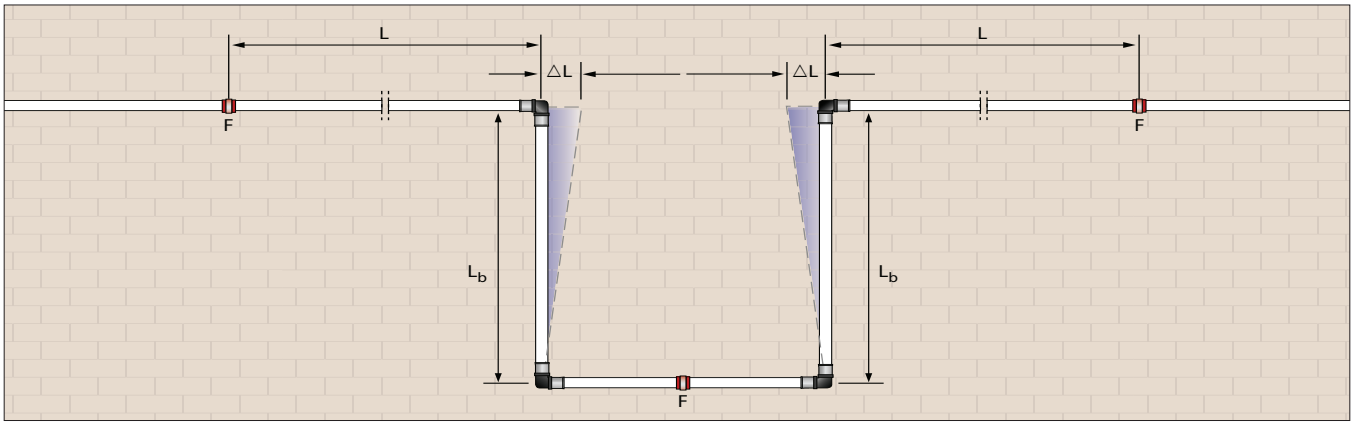


L = length of the pipe
L_b = length of the expansion bend
ΔL = change in length

F = fixed point
GL = sliding point
Expansion bend for r L (L_b)

When a long pipe does not change direction expansion loops are required.
An **expansion loop** is also called a lyra or omega bend. The drawing below clarifies what an expansion loop is.

The expansion loop is in principle formed by two expansion bends. A fixed point must therefore be provided at the bottom in the middle of the loop.

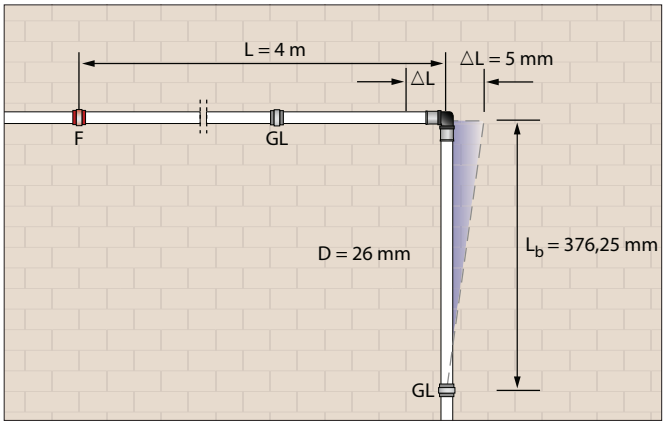


6 ASSEMBLY INSTRUCTIONS

The minimum length of the expansion bend can be calculated on the basis of the following formula or read from the diagram below:

$$L_b = C \times \sqrt{(D \times \Delta L)}$$

with: L_b = length of the expansion bend
C = material constant (=33)
D = outside diameter of the pipe
ΔL = change in length



Example:

Given: $L = 4\ m$
$D = 26\ mm$
$\Delta T = 50°C$ (Tmin=10°C en Tmax= 60°C)

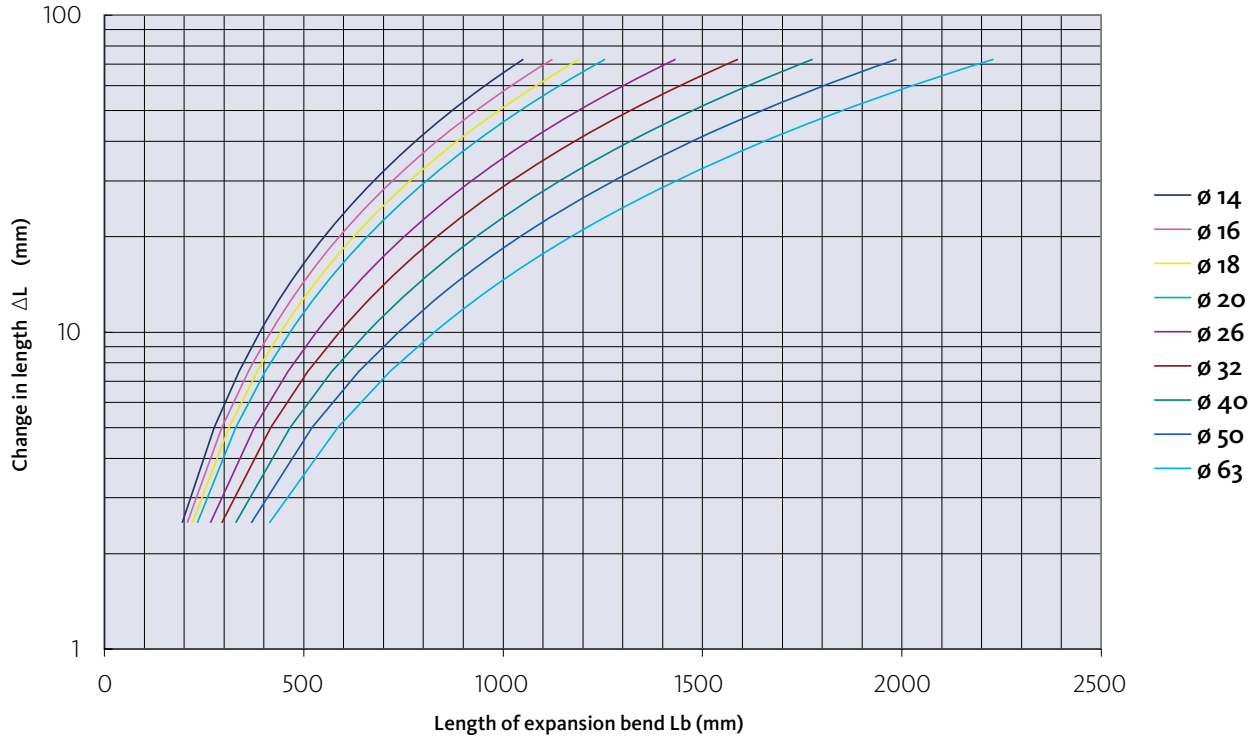
Asked: L_b

Solution: $L_b = C \times \sqrt{(D \times \Delta L)}$

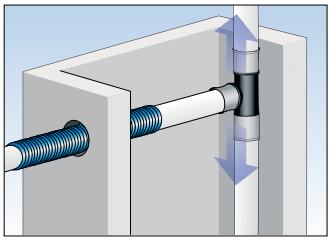
with $\Delta L = L \times \alpha \times \Delta T$
$= 4 \times 0{,}025 \times 50$
$= 5\ mm$

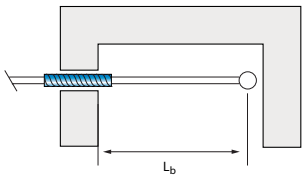
$L_b = C \times \sqrt{(D \times \Delta L}$
$= 33 \times \sqrt{26 \times 5}$
$= 376{,}25\ mm$

For a pipe with a diameter of 26 mm and a length of 4 m that has a change of direction, with a temperature difference of 50°C an expansion bend of 376.25 mm will have to be provided to accommodate the change in length.

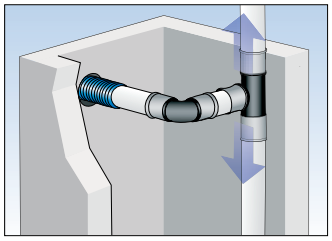


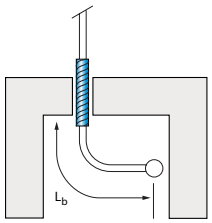
It must also be ensured that pipes can freely move **when piping runs from floors to a riser pipe in a shaft**. Also here, the change in length can be accommodated by an expansion bend. The expansion bend will then accommodate the upward and downward movements.



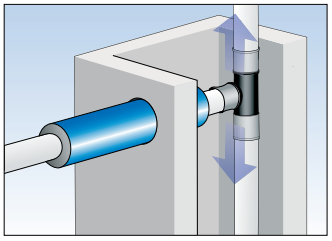


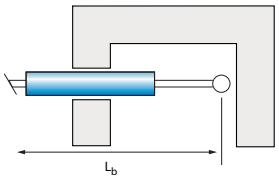
If the shaft is large enough and there is space to fit the calculated expansion bend, it suffices to give the pipe a protective sleeve at the hole in the wall.



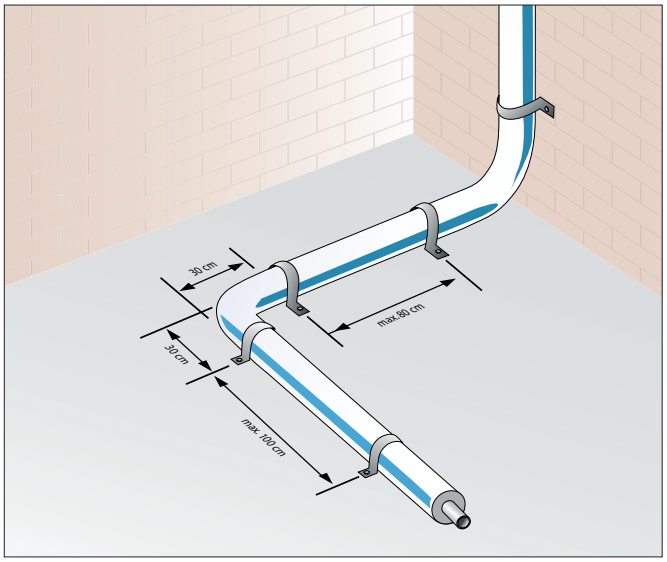


If the shaft is too small to fit the calculated expansion bend, the hole in the wall will have to be made larger to give the pipe sufficient room for movement. The pipe must be provided at the hole in the wall with PE insulation.



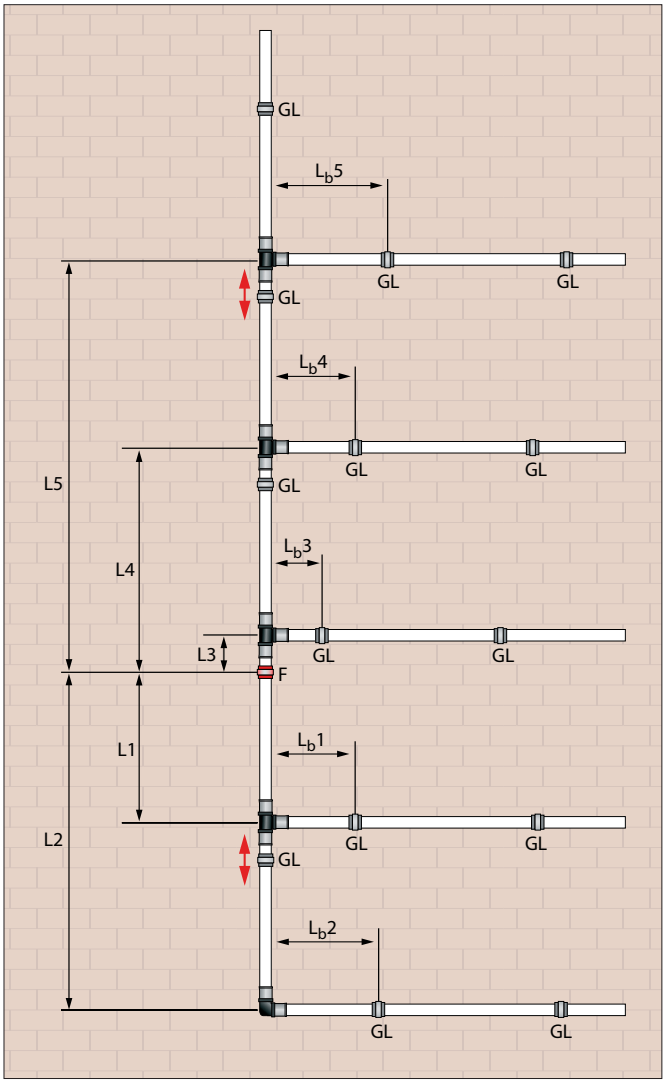


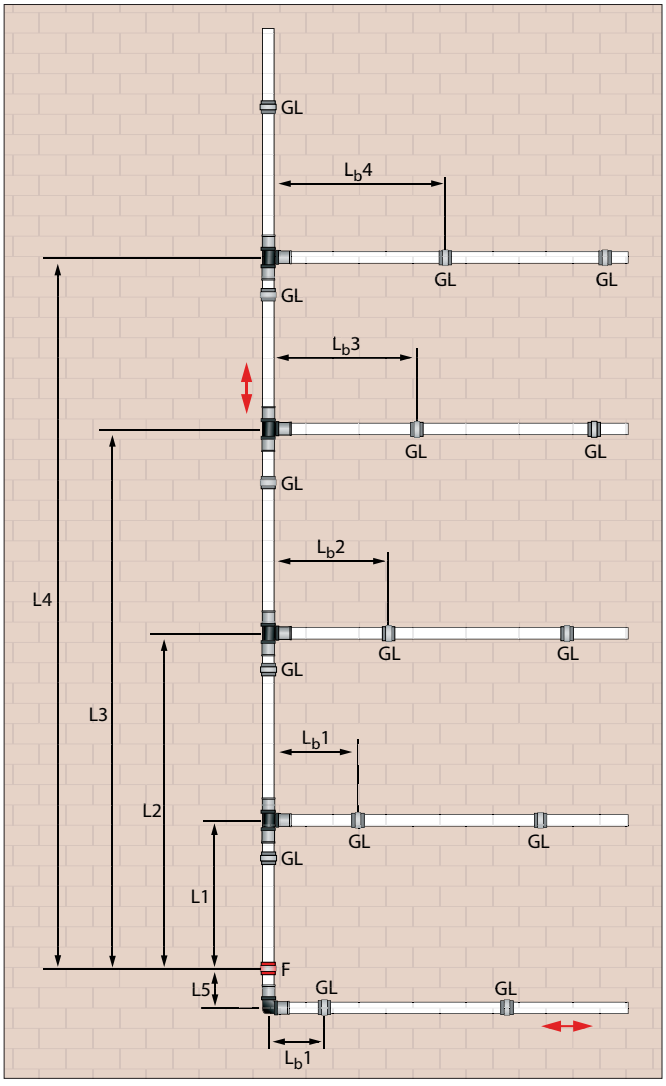
For installations where Henco multilayer pipes are laid **straight on floor**, a fixing distance applies of max. 80 cm. Before and after a 90° bend, fixing by pipe brackets must be provided at 30 cm.



If the riser pipe is longer than 10 m a fixed point must always be provided. It is recommended to have this point in the middle of the pipe because then the expansion forces generated will be smaller.

The drawings show that the total length of the expansion bends one must provide if one has the fixed point in the middle of the riser pipe it is much less than when one has the fixed point at the start of the riser pipe.





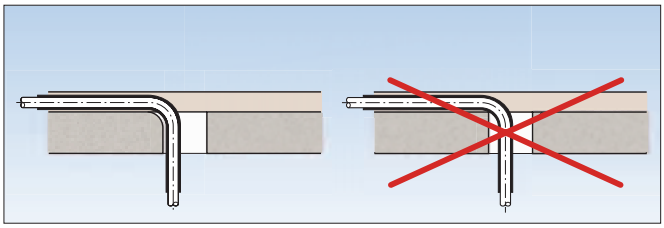
$L_{b1} + L_{b2} + L_{b3} + L_{b4} + L_{b5}$ < $L_{b1} + L_{b2} + L_{b3} + L_{b4} + L_{b5}$

6.6 Flush mounted fittings

The metal parts of the flush mounted fittings must be protected against corrosion. This can be by means of easily accessible, waterproof built-in boxes, tape-sealed protective sleeve, or a tape-sealed encasing of a synthetic cellular material.
The materials used for this must not affect neither the pipe nor the fitting.

6.7 Pipes through ceiling holes

Besides at holes in the wall, at holes in the ceiling the pipes must at least be provided with a sleeve. In addition, the pipes may never be bent around a sharp edge to prevent kinking. It is advised to round off the edges.



6.8 Pipes in danger zones

When laying Henco multilayer pipes in zones subject to aggressive gases (stables, etc.) or permanently penetrating humidity (industrial kitchens, swimming pools, etc.), it is necessary to protect the metal connections. This can be by means including the use of appropriate anti-rust strips or heat-shrinking materials according to DIN 1988/7

6.9 Pipe insulation

With the application of other pipe insulation than that of the manufacturer one must check if any adhesives to be used contain products harmful to the pipe and fittings, even if not directly required to adhere the insulation to the plastic pipe.

6.10 Frost protection and trace heating

The system is suitable for the use of trace heating. The aluminium pipe guarantees equal heat transfer over the whole area of the pipe. The fastening of the additional heating to the pipe takes place at normal indoor temperatures using cables or self-adhesive tape. Consult Henco when use is made of self-adhesive tape for the fastening of the trace heating to the pipe, or for better heat distribution. Trace heating must be technically approved. With the use of additional heating the temperature of the drinking water may not be higher than 60°C.
It must be ensured that additional heating is switched off for water that is not circulating.

6.11 Disinfection and chlorination

The producer must be consulted beforehand in the case of the use of disinfecting products or the application of a thermal cycle with temperatures higher than the specified temperature for use.

6.12 Earthing (conductivity)

The Henco system is not electrically conductive, and is consequently unsuitable for electrical earthing of whatever type.

6.13 Pressure tests

6.13.1 Pressure test for sanitary installations (DIN 1988)

- Use pressure gauges which can measure a pressure difference of 0.1 bar.
- The pressure gauge must be fitted at the lowest point of the installation.
- The installation must not yet be concealed.
- The pipes are filled with filtered water without air.

Two tests are to be conducted, an introductory test and a main test.

The introductory test

- The pressure test takes place at a pressure of 15 bar, i.e. the maximum permitted working pressure of 10 bar, plus 5 bar extra.
- The installation must be put under this pressure twice for 30 minutes, with an interval of 10 minutes.
- Then follows another 30-minute test in which the pressure must not drop by more than 0.6 bar (0.1 bar per 5 minutes) and the installation must remain watertight.

The main test

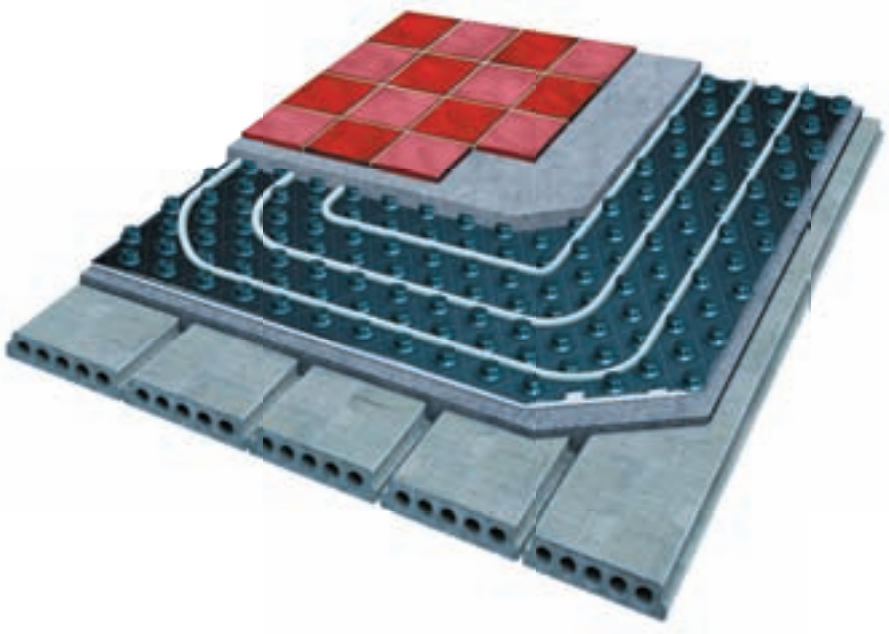
- The main test must take place immediately after the introductory test.
- This test must last for 2 hours.
- The pressure measured in the introductory test must not have dropped by more than 0.2 bar after these 2 hours.
- The installation must remain 100% watertight.

6.13.2 Pressure test for radiator installation (DIN 18380)

- The installer must check the sealing of the water pipes before these are concealed with cement, plaster or other materials.
- Use pressure gauges which can measure a pressure difference of 0.1 bar.
- The pressure gauge must be fitted at the lowest point of the installation.
- The heating installation must be put under water pressure and de-aerated (if necessary protected against frost).
- The heating pipe must undergo a pressure test at a pressure 1.3 times greater than the total pressure of the installation (static pressure), with at least 1 bar over-pressure at each point of the installation.
- The pressure test must take place over 24 hours.
- The pressure must not drop by more than 0.2 bar.
- The installation must remain watertight.
- Once the water has cooled down check whether all the pipes and fittings have remained watertight.

6.13.3 Pressure tests on floor heating installation (DIN 4725)

- Before covering the heating circuit with anhydride or cement-bound concrete check its water-tightness (perform water pressure test).
- Use pressure gauges which can measure a pressure difference of 0.1 bar.
- The pipes must first be put entirely under water pressure and de-aerated.
- The water pressure must be tested just before and just after placing of the covering floor.
- The test pressure must be 1.3 times greater than the operating pressure.
- Henco recommends testing the composite pipes in floor heating circuits at 6 bar, and this over a period of 24 hours.
- Make sure the shut-off valves for the floor heating manifold are fully closed so that the test pressure remains isolated from the rest of the installation.
- The pressure must not drop by more than 0.2 bar a nd the installation must remain watertight.
- When pouring the cement floor the operating pressure must be reduced to the maximum permis sible operating pressure.
- Suitable measures are to be taken in case of frost (use anti-frost products or heat the building).
- If the heating system is no longer exposed to frost (e.g. if a building is inhabited) the anti-frost product must be completely removed from the piping circuit. The installation must be flushed with clean water at least three times as anti-frost products may cause corrosion on the metal parts of the floor heating system



6.13.4 Pressure test protocols

6.13.4.1 For sanitary installations

HENCO PRESSURE TEST PROTOCOL FOR SANITARY APPLICATIONS
(according to DIN 1988)

Project .....

Building site .....

Client ..... Installing company .....

Name of the person carrying out test .....

Start of the test Date ..... Time .....

Area tested .....

Was the piping filled and fully vented with filtered water? ☐ Yes ☐ No

Ambient temperature ..... °C Water temperature ..... °C

Type Henco pipe ☐ Ø16 ☐ Ø18 ☐ Ø20 ☐ Ø26
☐ Ø32 ☐ Ø40 ☐ Ø50 ☐ Ø63

Total pipe length ..... m

Visual check of the press or screw fittings made? ☐ Yes ☐ No

Press fittings were pressed or screw fittings screwed on? ☐ Yes ☐ No

INTRODUCTORY TEST

Max. allowed working pressure is 10 bar, the test pressure is 15 bar ☐ Yes ☐ No

Pressure at start of test ..... bar time .....

Stop the test after 30 minutes for 10 minutes, and then test again for 30 minutes.

Test pressure (30 minutes after start of the test) ..... bar time .....

Test pressure (60 minutes after start of the test) ..... bar time .....

Pressure loss per 5 minutes ..... bar

(max. 0.1 bar per 5 minutes and max. 0.6 bar in total)

Was a leak established during the pressure test? ☐ Yes ☐ No

Was the max. pressure loss exceeded during the pressure test? ☐ Yes ☐ No

MAIN TEST (immediately after the preparatory test for 2 hours)

Test pressure (at start of main test) ..... bar time .....

Test pressure (after 2 hours) ..... bar time .....

(pressure loss may be max. 0.2 bar)

Was a leak established during the pressure test? ☐ Yes ☐ No

Place ..... Date .....

Signature of client Signature of installer

6.13.4.2 For installations with radiators

HENCO PRESSURE TEST PROTOCOL FOR RADIATORS
(according to DIN 18380)

Project .....

Building site .....

Construction phase .....

Allowed max. working pressure (measured at the lowest point of the installation.) ..... bar

Height of the installation ..... m

Parameters — Supply temperature ..... C°

Return temperature ..... C°

Name of the person carrying out the test .....

Start test — Date ..... Time .....

End test — Date ..... Time .....

Type pressing machine .....

Type jaw .....

Type pipe .....

Pressure loss (may be max. 0.2 bar) ..... bar

The installation described above was heated to working temperature on ..... (date) and no leaks were established. Neither were any leaks observed after cooling down.

Was a visual check carried out to examine if all connections were assembled in the correct manner?

☐ yes ☐ No

With danger of frost the necessary measures must be taken (use anti-freeze products or heat the building). Once the heating is no longer exposed to frost, the anti-freeze products must be fully removed from the piping. The installation must be rinsed at least 3 times with fresh water to achieve this.

Was an anti-freeze product added to the water? ☐ yes ☐ No

If so, was the piping rinsed at least 3 times? ☐ yes ☐ No

Place ..... Date .....

Signature of client

Signature of installer

6.14 UV-resistance

The Henco multilayer pipe must be protected against direct sunlight or UV-irradiation. Once removed from the packaging it must be covered during storage or transport. If when under construction the pipes are fitted with a protective sleeve or insulation they are then perfectly protected against UV radiation.

6.15 Legionnaire's disease

Legionella bacteria occur in all fresh water, so also mains water, but they can only grow and become a risk under a number of specific conditions which particularly concern the design and maintenance of the installation, and not the type of pipe used in the installation. The temperature of the water plays an important part. The bacteria are inactive and therefore not dangerous below 25°C. A water temperature of 60°C is too hot. The bacterium does not like running water. The danger occurs in water with a temperature between 25°C and 50°C that atomised. If the conditions are favourable for the bacterium, old pipes that are damaged or otherwise affected by corrosion can assist the growth of the legionella bacterium.

The Henco pipe is corrosion-resistant thanks to the smooth wall of the cross-linked inner pipe. Only preventive measures can be taken such as:

- Set the temperature of the boiler so that the supply pipe stays at a temperature of least 60°C. Set the return to 50°C and have the mixing take place as near as possible to the sanitary branch point (e.g. shower).
- Regularly rinse all pipes with sufficiently hot water, certainly after a long absence.
- Empty unused piping.
- Avoid uncirculating water.

6.16 Fire classification

The Henco multilayer pipe, consisting of two cross-linked polyethylene layers and a butt welded aluminium layer, belongs according to DIN 4102 part 1 to class B2 (normally inflammable construction elements).

HENCO TS, THE “TOTAL SAFE” PIPING SYSTEM

7 Henco TS: the guaranteed “TOTAL SAFE” piping system

Heating installations in newly built homes are in most cases provided with a piping network within the floor. The Henco TS system is the perfect solution for this application. As distinct from systems with manifolds where the radiators are separately connected, the Henco TS system uses one main pipe per floor, where the radiators are connected by means of crossing-free T-pieces as a two-pipe system.

Advantages:

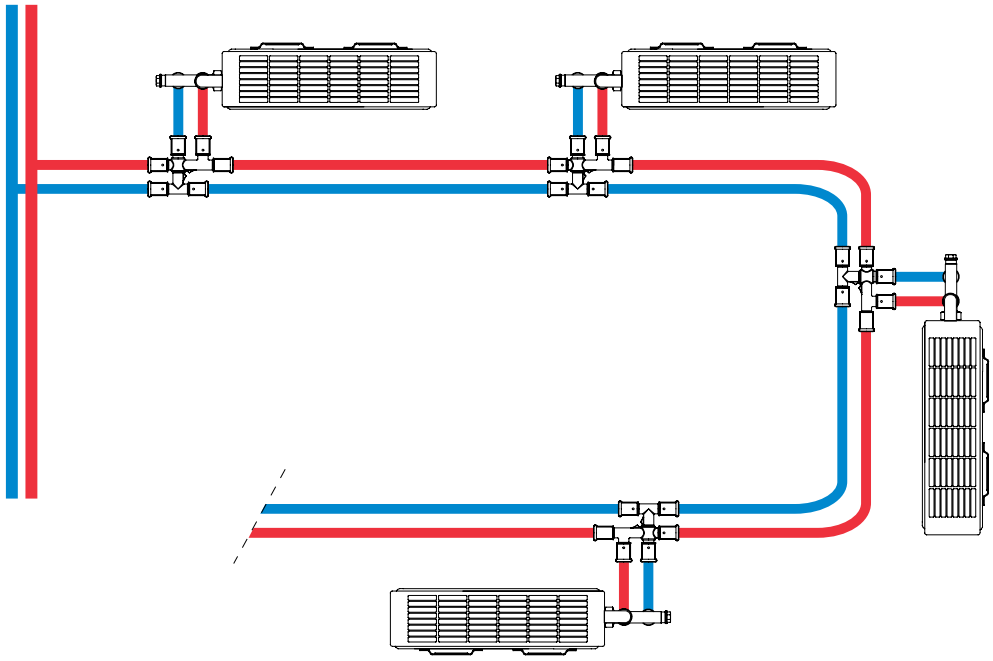
- No manifold needed.
- The quantity of piping needed is less.
- The thermal load on the floor decreases greatly.

The crossing-free T-pieces ensure that no pipes have to be laid on top of each other.

Because heating installations are usually calculated with operating temperatures higher than 40°C, the piping to be laid must have a sleeve or insulation (NEN 2741 NED.). It is also recommended to provide the crossing-free T-pieces with insulation boxes.

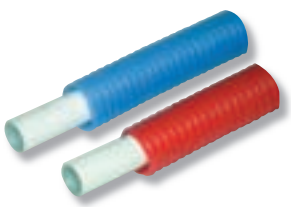
The Henco TS system consists of the following components:

- Henco Pe-Xc/AL/Pe-Xc pipes with protective sleeve or insulation
- Crossing-free T-pieces with insulation boxes
- Press fittings and screw fittings
- Connection combinations for radiators
- Radiator valves for manual and thermostatic operation
- Fastening materials



ISO-BOX

Crossing-free T-piece



Henco PE-Xc/AL/PE-Xc pipes with sleeve

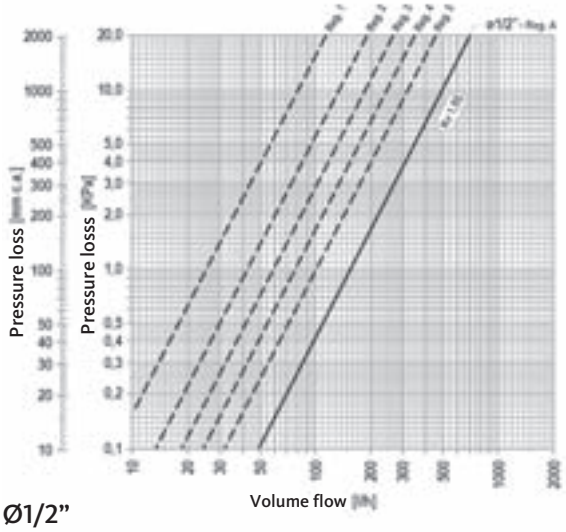
7 THE HENCO TS SYSTEM

Overview of the components				
	Description		Type	Art. no.
	Kruisingsvrije pers T-stukken		16 x 16 x 16	31P-161616
			20 x 16 x 16	31P-201616
			20 x 16 x 20	31P-201620
			20 x 20 x 20	31P-202020
	Bottom block with 3/4" euroconus connections, squared		1/2" x 3/4"	RAD04-100H
	Bottom block with 3/4" euroconus connections, straight		3/4" x 3/4"	RAD04-100V
	Connector for H-block		1/2" x 3/4"	RADNI-0504
	Euroconus screw coupling copper/steel		15 mm	EK15
	Euroconus screw coupling synthetic		16 mm	EK16
	Connecting pipe chromed	600 mm	15 mm	RADP-600
		1000 mm	15 mm	RADP-1000
	Thermostatic radiator valve, manually operated, straight		1/2" x 3/4"	
	Thermostatic radiator valve, manually operated, squared		1/2" x 3/4"	
	Radiator connection bend 1/2" X 3/4" euroconus		1/2" x 3/4"	RAD-B
	Therm. radiator valve 1/2" squared x 3/4" euroconus, adjustable		1/2" x 3/4"	RADK2-HT
	Therm. radiator valve 1/2" straight x3/4" euroconus, adjustable		1/2" x 3/4"	RADK2-RT
	Therm. radiator valve 1/2" squared reversed x 3/4" euroconus, adjustable		1/2" x 3/4"	RADK2-HVT
	Handwheel for thermostatic radiator valve			RAD-H
	Thermostatic control element			RADTH-VL
	Henco pipe bends		16 mm	LB 45/50
	Double radiator bend, through-connected end	centre-to-centre distance 40 mm	16x1/2"x40	38P-160440
		centre-to-centre distance 50 mm	16x1/2"x50	38P-160450
	Double radiator bend, open end	centre-to-centre distance 40 mm	16x1/2"x40	38P-160440
		centre-to-centre distance 50 mm	16x1/2"x50	38P-160450

For the best performance of the installation according to the Henco TS system the radiators must be separately balanced.

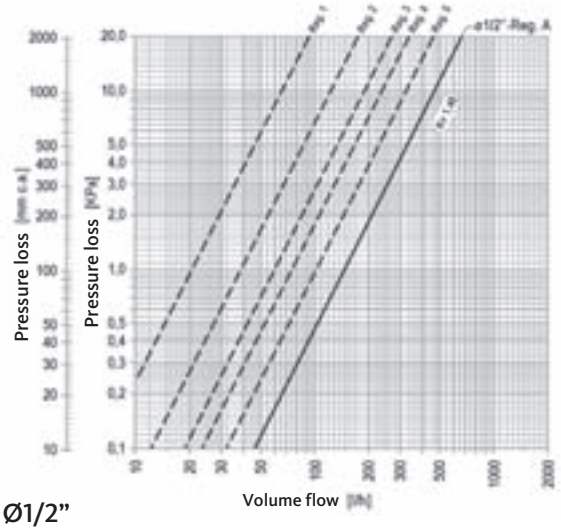
Setting diagrams

Setting diagram for thermostatic radiator valves



Ø1/2”

Setting diagram for thermostatic radiator valves

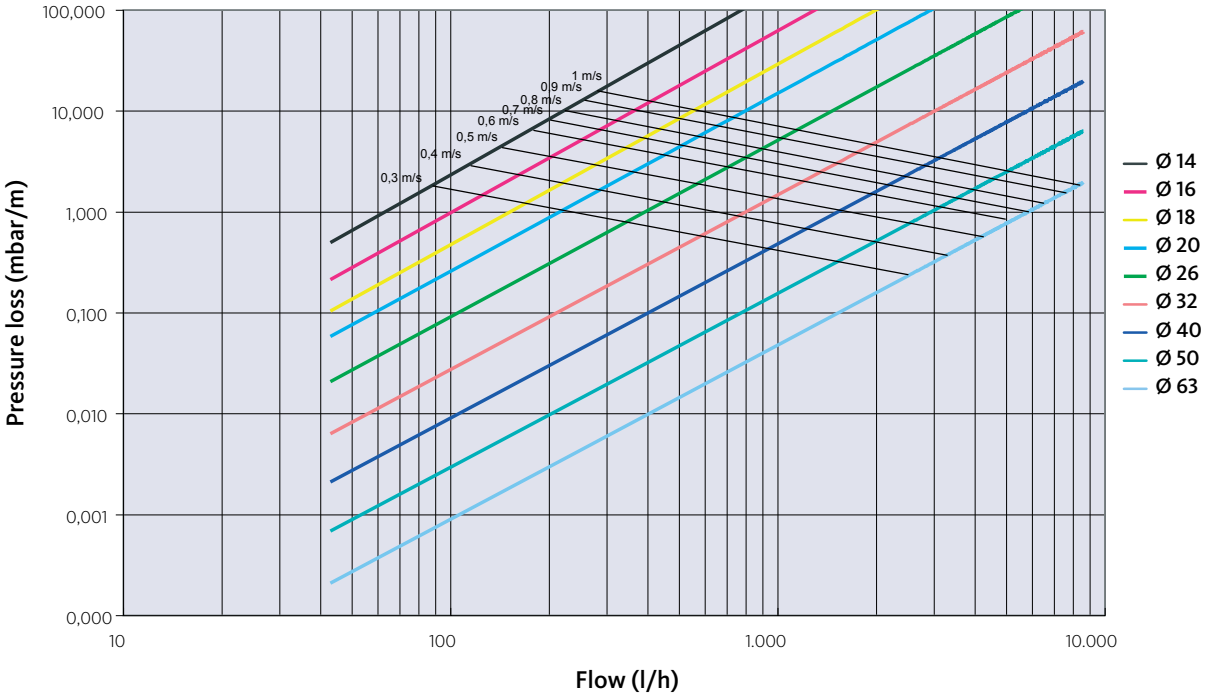


Ø1/2”

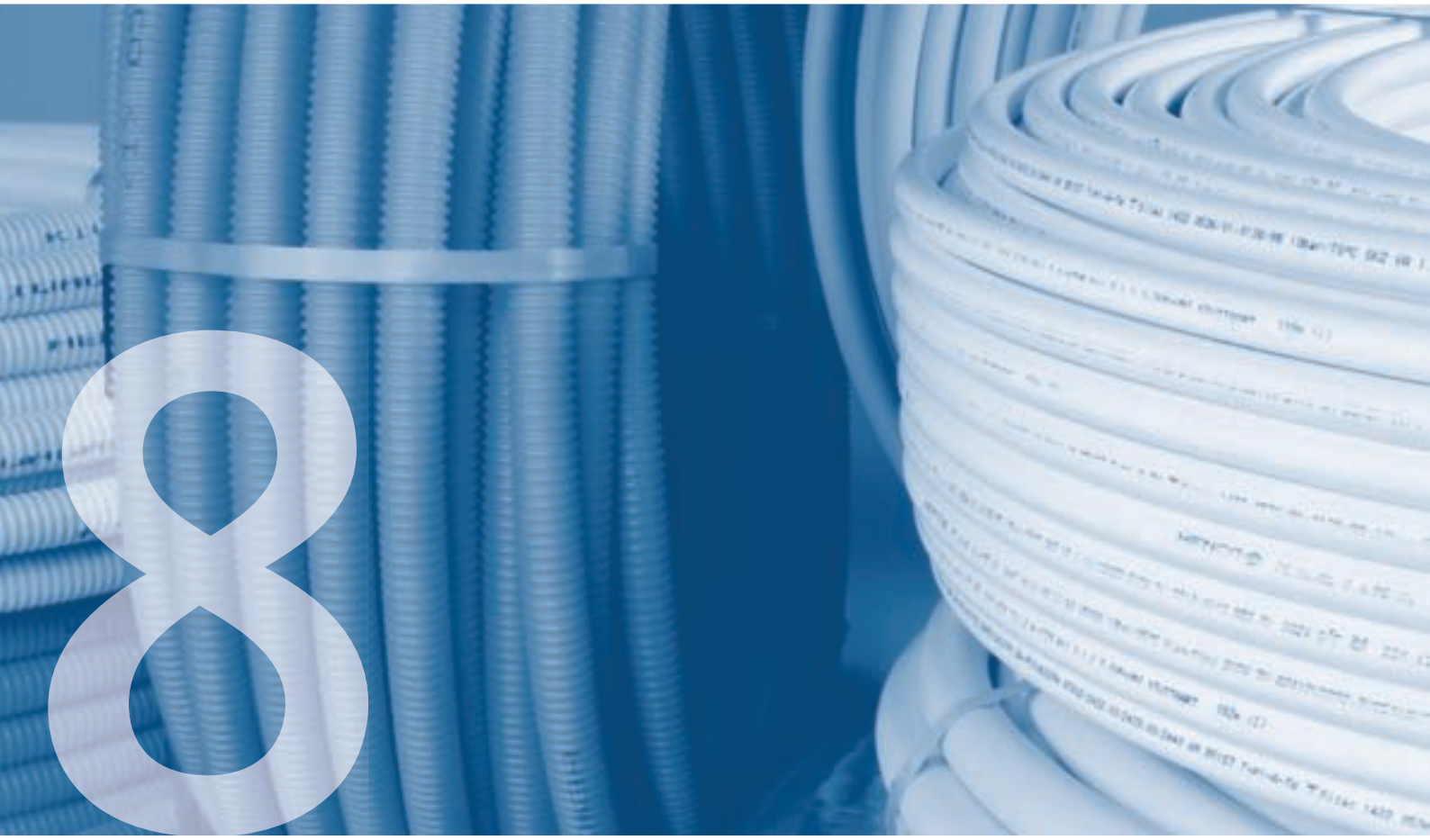
For piping calculation the KV-values of the crossing-free press T-pieces are as follows:

Circulation	31P-161616	kv-value 1,2
	31P-201616	kv-value 1,6
	31P-201620	kv-value 3,3
	31P-202020	kv-value 3,3

Pressure loss diagram



SPECIFICATIONS



8.1 Sanitary installation

1 General description

The piping for sanitary applications comprises composite pipes and press fittings. The entire system is technically approved and certificated by the most important test institutes such as e.g. DVGW, KIWA and WRAS.

2 Materials and characteristics

2.1 Pipes

2.1.1 Composition

The pipes consist of 5 layers:

- Inner pipe of electron beam cross-linked polyethylene (PE-Xc), extruded from high density polyethylene granulates
- High quality connecting layer for a homogenous connection between the aluminium pipe and the PE-Xc inner pipe
- An aluminium pipe, longitudinally seamlessly welded and controlled by machine
- A high quality connecting layer for a homogenous connection between the aluminium pipe and the PE-Xc outer pipe
- An outer pipe of electron beam cross-linked polyethylene (PE-Xc), extruded from high density polyethylene granulates

2.1.2 Technical profile

Outer diameter (mm)	14	16	16 RIXc	18	20	20 RIXc	26	26 RIXc	32	40	50	63
Inner diameter (mm)	10	12	12	14	16	16	20	20	26	33	42	54
Wall thickness (mm)	2	2	2	2	2	2	3	3	3	3,5	4,0	4,5
Thickness of aluminium (mm)	0,4	0,4	0,2	0,4	0,4	0,28	0,5	0,28	0,7	0,7	0,9	1,2
Max. working temperature (°C)	95	95	95	95	95	95	95	95	95	95	95	95
Max. working pressure (bar)	10	10	10	10	10	10	10	10	10	10	10	10
Coefficient of thermal conduction (W/m/K)	0,43	0,43	0,43	0,43	0,43	0,43	0,43	0,43	0,43	0,43	0,43	0,43
Linear expansion coefficient (mm/m/K)	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025
Surface roughness of inner pipe (µ)	7	7	7	7	7	7	7	7	7	7	7	7
Oxygen diffusion (mg/l)	0	0	0	0	0	0	0	0	0	0	0	0
Smallest bending radius manual / external spiral spring (mm)	5xDu	5xDu	8xDu	5xDu	5xDu	7xDu	5xDu	7xDu	*	*	*	*
Smallest bending radius with internal spiral spring (mm)	3xDu	3xDu	8xDu	3xDu	3xDu	5xDu	3xDu	5xDu	*	*	*	*
Degree of cross-linking (%)	60	60	60	60	60	60	60	60	60	60	60	60
Weight (kg/m)	0,108	0,125	0,101	0,132	0,147	0,129	0,252	0,261	0,39	0,528	0,766	1,155
Water volume (l/m)	0,072	0,113	0,113	0,154	0,201	0,201	0,314	0,314	0,53	0,803	1,32	2,042
Per coil (m)	100 200	50 100 200	100 200	100 200	100	100	50	50	50	-	-	-
Per straight length	4-5	4-5	4-5	4-5	4-5	4-5	4-5	4-5	4-5	4-5	4-5	4-5

* necessary to use elbow fittings

2.1.3 Marking

The marking on the pipes (repeated every meter) is structured as follows:

HENCO®	registered trademark
MADE IN BELGIUM	place of production
www.henco.be	website
PE-Xc	cross-linked high-density polyethylene
AL 0,4	0.4 aluminium (depending on pipe Ø)
PE-Xc	cross-linked high-density polyethylene
16*2	outer diameter *wall thickness
201905	date of production
L238	line and time code
HN000	code for Henco mark
10bar / 95°C	nominal working pressure – max. temp
Kiwaklasse2ISO1/Komo	Dutch certificate
DVGW DW...	German certificate
ÖVGWW1.377	Austrian certificate
ATG...	Belgian certificate
ÖN B5157 Typ1-A-TW	Austrian certificate
Sitac1422 0536/01;0138/98 10 bar/70°C SKZ	Swedish certificate
VA 1.14/12039	Danish certificate
UNI10954-1tipoAclasse1IIPUNI319	Italian certificate
SVGW...	Swedish certificate
NBI...	Norwegian certificate
STF	Finnish certificate
	KIWA watermark
DIN...	German standard
001m<l>	meter indication

2.1.4 Pipe with protective sleeve

The multilayer pipe and protective sleeve will be produced by the same manufacturer. The sleeve consists of polyethylene and has a red, blue or black colour. In his laying instructions the manufacturer describes when and in which conditions the pipe must be fitted with a sleeve.
The pipe with protective sleeve must be available in the following sizes:

Pipe sleeve		
Measure	Coil length	Colour
14x2	25 m	blue/red/black
	50 m	blue/red/black
	100 m	blue/red/black
16x2	25 m	blue/red/black
	50 m	blue/red/black
	100 m	blue/red/black
18x2	50 m	blue/red/black
	100 m	blue/red/black
20x2	25 m	blue/red/black
	50 m	blue/red/black
26x3	50 m	blue/red/black

2.1.5 Pre-insulated pipe

The insulation must be PE foam, provided with a round or eccentric PE film in a red or blue colour. The multilayer pipes and insulation must come from the same manufacturer. The insulation must satisfy the following conditions:

Quality standard	UNI and ISO 9002-94
Lambda value	0.040 W/mK at + 40°C
Fire class	1 - UNI 9177 and UNI 8457
Temperature resistance	-35°C to + 95°C
Thickness (round)	6, 10 or 13 mm
Thickness (eccentric)	6 mm above and 13 or 26 mm below

The pre-insulated pipes are available in the following dimensions:

Round insulation						
	6 mm		10 mm		13 mm	
Dimension	Coil length	Colour	Coil length	Colour	Coil length	Colour
14x2	100 m	red or blue	50 m	red or blue	-	-
16x2	100 m	red or blue	50 m	red or blue	50 m	blue
18x2	50 m	red or blue	50 m	red or blue	-	-
20x2	50 m	red or blue	50 m	red or blue	50 m	blue
26x3	25 or 50 m	red or blue	25 m	red or blue	50 m	blue
32x3	25 m	red or blue	-	-	-	-

Eccentric insulation				
	6 mm above and 13 mm below		6 mm above and 26 mm below	
Dimension	Coil length	Colour	Coil length	Colour
16x2	50 m	blue	25 m	blue
20x2	25 m	blue	25 m	blue
26x3	25 m	blue	25 m	blue

2.2 Fittings

The whole sanitary installation, with the exception of the connections to the manifolds, is connected by press fittings of polyvinylidene fluoride (PVDF). The synthetic press fittings and the multilayer pipes must be produced by the same manufacturer.

The PVDF press fittings must be fitted with O-rings to ensure sealing between the pipe and fitting. The pressure sleeves must be stainless steel. They are also provided with 3 openings for visual checks, and a special rim that allows the perfect positioning of the fitting in the jaws specified by the manufacturer.

If brass press fittings are used, these must come from the same manufacturer and be provided with a synthetic insulating ring to prevent electrolysis between the aluminium of the pipe and the brass of the fitting. The fittings must also be fitted with O-rings and pressure sleeves in stainless steel.

2.3 Manifolds

All manifolds are made of brass. The manifolds exist in 1" or 3/4" designs and have 2 to 10 branches with euroconus connections.
They are also fitted with a 3/8" screw thread for the fitting of an automatic air vent.
The centre-to-centre distance between the branches amounts to 50 mm, and the distance from the outside of the brass to the middle of the first branch amounts to 26 mm.

The galvanised manifolds are provided with ball valves and a euroconus connection on each outlet. These manifolds are provided with 2, 3 or 4 connections.
They are supplied as constituent elements that can be attached to each other, with at one end a female thread and the other end a 1" or 3/4" male thread.
Assembly of the manifolds on the wall is exclusively using wall brackets specified by the manufacturer. The cabinets for the manifolds must also come from the same manufacturer.

3 Connections

The pipes and the fittings are connected according to the press-fit procedure. This must be done using the tools from the manufacturer and according to the assembly instructions given by the manufacturer.
To make the connection between pipes and manifolds one must use fittings designed by the manufacturer provided with a separate euroconus assembly nut; these fittings are provided with O-rings, a stainless steel pressure sleeve and a synthetic ring.

4 Pressure tests

The whole sanitary installation must undergo pressure tests in conformity with DIN 1988 as specified by the manufacturer.

5 Insurance and guarantee

The manufacturer must be able to present a test certificate from the IKP university in Stuttgart demonstrating compliance with the DIN 4726 standard and/or DVGW approval and/or KIWA approval and/or ATG approval.

The pipe is insured against damage after delivery for a period of at least 12 years and for a sum of 3,000,000 euros per case of damage per year. A guarantee certificate is always supplied.

8.2 Heating installation

1 General description

The piping for heating applications comprises composite pipes and press fittings. The entire system is technically approved and certificated by the most important test institutes such as e.g. DVGW, KIWA and WRAS.

2 Materials and characteristics

2.1 Pipes

2.1.1 Composition

The pipes consist of 5 layers:

- Inner pipe of electron beam cross-linked polyethylene (PE-Xc), extruded from high density polyethylene granulates
- High quality connecting layer for a homogenous connection between the aluminium pipe and the PE-Xc inner pipe
- An aluminium pipe, longitudinally seamlessly welded and controlled by machine
- A high quality connecting layer for a homogenous connection between the aluminium pipe and the PE-Xc outer pipe
- An outer pipe of electron beam cross-linked polyethylene (PE-Xc), extruded from high density polyethylene granulates

2.1.2 Technisch profiel

Outer diameter (mm)	14	16	16 RIXc	18	20	20 RIXc	26	26 RIXc	32	40	50	63
Inner diameter (mm)	10	12	12	14	16	16	20	20	26	33	42	54
Wall thickness (mm)	2	2	2	2	2	2	3	3	3	3,5	4,0	4,5
Thickness of aluminium (mm)	0,4	0,4	0,2	0,4	0,4	0,28	0,5	0,28	0,7	0,7	0,9	1,2
Max. working temperature (°C)	95	95	95	95	95	95	95	95	95	95	95	95
Max. working pressure (bar)	10	10	10	10	10	10	10	10	10	10	10	10
Coefficient of thermal conduction (W/m/K)	0,43	0,43	0,43	0,43	0,43	0,43	0,43	0,43	0,43	0,43	0,43	0,43
Linear expansion coefficient (mm/m/K)	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025
Surface roughness of inner pipe (µ)	7	7	7	7	7	7	7	7	7	7	7	7
Oxygen diffusion (mg/l)	0	0	0	0	0	0	0	0	0	0	0	0
Smallest bending radius manual / external spiral spring (mm)	5xDu	5xDu	8xDu	5xDu	5xDu	7xDu	5xDu	7xDu	*	*	*	*
Smallest bending radius with internal spiral spring (mm)	3xDu	3xDu	8xDu	3xDu	3xDu	5xDu	3xDu	5xDu	*	*	*	*
Degree of cross-linking (%)	60	60	60	60	60	60	60	60	60	60	60	60
Weight (kg/m)	0,108	0,125	0,101	0,132	0,147	0,129	0,252	0,261	0,39	0,528	0,766	1,155
Water volume (l/m)	0,072	0,113	0,113	0,154	0,201	0,201	0,314	0,314	0,53	0,803	1,32	2,042
Per coil (m)	100 200	50 100 200	100 200	100 200	100	100	50	50	50	-	-	-
Per straight length	4-5	4-5	4-5	4-5	4-5	4-5	4-5	4-5	4-5	4-5	4-5	4-5

* necessary to use elbow fittings

2.1.3 Marking

The marking on the pipes (repeated every meter) is structured as follows:

HENCO®	registered trademark
MADE IN BELGIUM	place of production
www.henco.be	website
PE-Xc	cross-linked high-density polyethylene
AL 0,4	0.4 aluminium (depending on pipe Ø)
PE-Xc	cross-linked high-density polyethylene
16*2	outer diameter *wall thickness
201905	date of production
L238	line and time code
HN000	code for Henco mark
10bar / 95°C	nominal working pressure – max. temp
Kiwaklasse2ISO1/Komo	Dutch certificate
DVGW DW...	German certificate
ÖVGWW1.377	Austrian certificate
ATG...	Belgian certificate
ÖN B5157 Typ1-A-TW	Austrian certificate
Sitac1422 0536/01;0138/98 10 bar/70°C SKZ	Swedish certificate
VA 1.14/12039	Danish certificate
UNI10954-1tipoAclasse1IIPUNI319	Italian certificate
SVGW...	Swedish certificate
NBI...	Norwegian certificate
STF	Finnish certificate
	KIWA watermark
DIN...	German standard
001m<I>	meter indication

2.1.4 Pipe with protective sleeve

The multilayer pipe and protective sleeve must be produced by the same manufacturer. The sleeve consists of polyethylene and has a red, blue or black colour. In his laying instructions the manufacturer describes when and in which conditions the pipe will be fitted with a sleeve.
The pipe with protective sleeve will be available in the following sizes:

Pipe sleeve		
Measure	Coil length	Colour
14x2	25 m	blue/red/black
	50 m	blue/red/black
	100 m	blue/red/black
16x2	25 m	blue/red/black
	50 m	blue/red/black
	100 m	blue/red/black
18x2	50 m	blue/red/black
	100 m	blue/red/black
20x2	25 m	blue/red/black
	50 m	blue/red/black
26x3	50 m	blue/red/black

2.1.5 Pre-insulated pipe

The insulation must be PE foam, provided with a round or eccentric PE film in a red or blue colour. The multilayer pipes and insulation must come from the same manufacturer. The insulation must satisfy the following conditions:

Quality standard	UNI and ISO 9002-94
Lambda value	0.040 W/mK at + 40°C
Fire class	1 - UNI 9177 and UNI 8457
Temperature resistance	-35°C to + 95°C
Thickness (round)	6, 10 or 13 mm
Thickness (eccentric)	6 mm above and 13 or 26 mm below

The pre-insulated pipes are available in the following dimensions:

Round insulation						
	6 mm		10 mm		13 mm	
Dimension	Coil length	Colour	Coil length	Colour	Coil length	Colour
14x2	100 m	red or blue	50 m	red or blue	-	-
16x2	100 m	red or blue	50 m	red or blue	50 m	blue
18x2	50 m	red or blue	50 m	red or blue	-	-
20x2	50 m	red or blue	50 m	red or blue	50 m	blue
26x3	25 or 50 m	red or blue	25 m	red or blue	50 m	blue
32x3	25 m	red or blue	-	-	-	-

Eccentric insulation				
	6 mm above and 13 mm below		6 mm above and 26 mm below	
Dimension	Coil length	Colour	Coil length	Colour
16x2	50 m	blue	25 m	blue
20x2	25 m	blue	25 m	blue
26x3	25 m	blue	25 m	blue

2.2 Fittings

The whole sanitary installation, with the exception of the connections to the manifolds, is connected by press fittings of polyvinylidene fluoride (PVDF). The synthetic press fittings and the multilayer pipes will be produced by the same manufacturer.

The PVDF press fittings must be fitted with O-rings to ensure sealing between the pipe and fitting. The pressure sleeves must be stainless steel. They are also provided with 3 openings for visual checks, and a special rim that allows the perfect positioning of the fitting in the jaws specified by the manufacturer.

If brass press fittings are used, these will come from the same manufacturer and be provided with a synthetic insulating ring to prevent electrolysis between the aluminium of the pipe and the brass of the fitting. The fittings must also be fitted with O-rings and pressure sleeves in stainless steel.

2.3 Manifolds

All manifolds are made of brass. The manifolds exist in 1" or 3/4" designs and have 2 to 10 branches with euroconus connections.
They are also fitted with a 3/8" screw thread for the fitting of an automatic air vent.
The centre-to-centre distance between the branches amounts to 50 mm, and the distance from the outside of the brass to the middle of the first branch amounts to 26 mm.

The galvanised manifolds are provided with ball valves and a euroconus connection on each outlet. These manifolds are provided with 2, 3 or 4 connections.
They are supplied as constituent elements that can be attached to each other, with at one end a female thread and the other end a 1" or 3/4" male thread.
Assembly of the manifolds on the wall is exclusively using wall brackets specified by the manufacturer. The cabinets for the manifolds must also come from the same manufacturer.

2.4 Valves and fittings for radiators

The valves and fittings as well as all other parts of the system will originate from the same manufacturer.
The valves and fittings must be fitted with euroconus connections.
The use of connections without universal millimetric thread is not allowed.
The thermostatic value and fittings must be fitted with an adjustable KV-value.
All heating bodies must be connected according to the two-pipe principle.

3 Connections

The pipes and the fittings are connected according to the press-fit procedure. This must be done using the tools from the manufacturer and according to the assembly instructions given by the manufacturer.
To make the connection between pipes and manifolds one must use fittings designed by the manufacturer provided with a separate euroconus assembly nut; these fittings are provided with O-rings, a stainless steel pressure sleeve and a synthetic ring.

4 Pressure tests

The whole sanitary installation must undergo pressure tests in conformity with DIN 1988 as specified by the manufacturer.

5 Insurance and guarantee

The manufacturer must be able to present a test certificate from the IKP university in Stuttgart demonstrating compliance with the DIN 4726 standard and/or DVGW approval and/or KIWA approval and/or ATG approval.

The pipe is insured against damage after delivery for a period of at least 12 years and for a sum of 3,000,000 euros per case of damage per year. A guarantee certificate is always supplied.

8.2 Gas

1 General description

HENCO GAS is only allowed in countries where testing has taken place and when a corresponding certificate is available. The Henco system for gas has Kiwa gas approval and is intended for the construction of gas installations within the home and for the transportation of gas according to NPR-3378-10/NEN 1078 part 10.

2 Materials and characteristics

2.1 Pipes

2.1.1 Composition

The pipes consist of 5 layers:

- Inner pipe of electron beam cross-linked polyethylene (PE-Xc), extruded from high density polyethylene granulates
- High quality connecting layer for a homogenous connection between the aluminium pipe and the PE-Xc inner pipe
- An aluminium pipe, longitudinally seamlessly welded and controlled by machine
- A high quality connecting layer for a homogenous connection between the aluminium pipe and the PE-Xc outer pipe
- An outer pipe of electron beam cross-linked polyethylene (PE-Xc), extruded from high density polyethylene granulates

The pipes are always coloured yellow.

2.1.2 Technical profile

Outer diameter (mm)	16	20	26	32
Inner diameter (mm)	12	16	20	26
Wall thickness (mm)	2	2	3	3
Thickness of aluminium (mm)	0,4	0,4	0,5	0,7
Max. working temperature (°C)	95	95	95	95
Max. working pressure (bar)	10	10	10	10
Coefficient of thermal conduction (W/m/K)	0,43	0,43	0,43	0,43
Linear expansion coefficient (mm/m/K)	0,025	0,025	0,025	0,025
Surface roughness of inner pipe (µ)	7	7	7	7
Oxygen diffusion (mg/l)	0	0	0	0
Smallest bending radius manual / external spiral spring (mm)	5xDu	5xDu	5xDu	*
Smallest bending radius with internal spiral spring (mm)	3xDu	3xDu	3xDu	*
Degree of cross-linking (%)	60	60	60	60
Weight (kg/m)	0,125	0,147	0,252	0,39
Inhoud (l/m)	0,113	0,201	0,314	0,53
Per coil (m)	50	50	50	50
Per straight length	4-5	4-5	4-5	4-5

* only elbow fittings

2.1.3 Pipe with protective sleeve

The multilayer pipe and protective sleeve must be produced by the same manufacturer. The sleeve consists of polyethylene and has a yellow colour.
In his laying instructions the manufacturer describes when and in which conditions the pipe must be fitted with a sleeve.
The pipe with protective sleeve must be available in the following sizes:

Pipe sleeve		
Measure	Coil length	Colour
16x2	50 m	yellow
20x2	50 m	yellow
26x3	50 m	yellow

3 Fittings

The installation is connected by press fittings of polyvinylidene fluoride (PVDF). The synthetic press fittings and the multilayer pipes must be produced by the same manufacturer.
The PVDF press fittings must have specific O-rings for gas. The pressure sleeves must be stainless steel. They are also provided with 3 openings for visual checks and a special rim that allows the perfect positioning of the fitting in the jaws specified by the manufacturer.
The pressure sleeves must have a yellow imprint mentioning the brand name and KIWAGAS.

4 Fitting and pressure tests

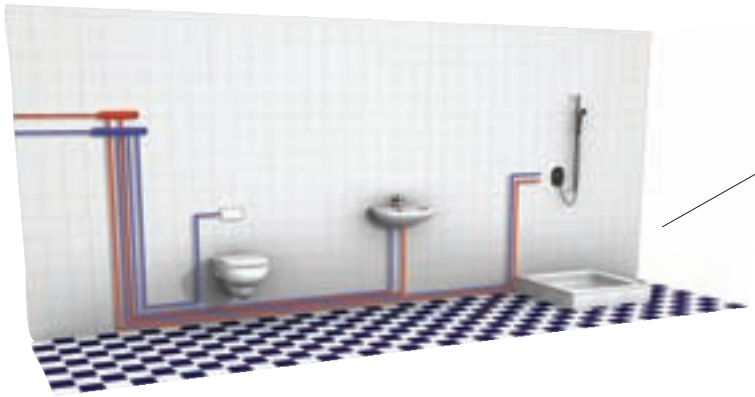
Fitting and pressure testing must take place as provided for in the relative standard. In the Netherlands this is NPR 3378-10.

5 Insurance and guarantee

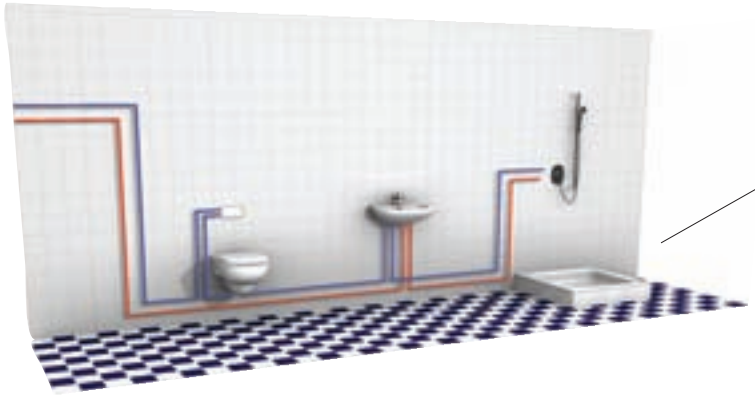
The manufacturer must be able to present a test certificate from the IKP university in Stuttgart demonstrating compliance with the DIN 4726 standard and/or DVGW approval and/or KIWA approval and/or ATG approval.

The pipe is insured against damage after delivery for a period of at least 10 years and for a sum of 3,000,000 euros per case of damage per year. A guarantee certificate is always supplied.

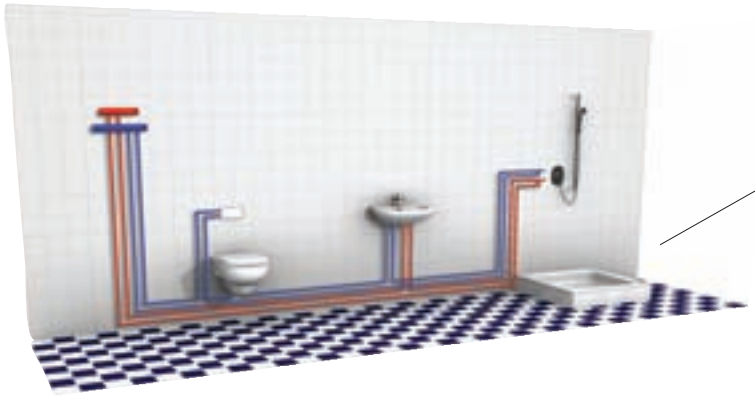
9.1 Sanitary



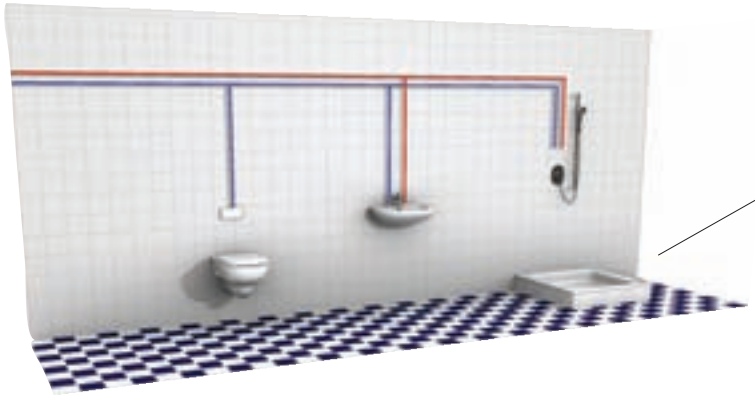
Each appliance is provided with hot or cold water by a separate supply pipe



All appliances are provided with hot or cold water by the same supply pipe

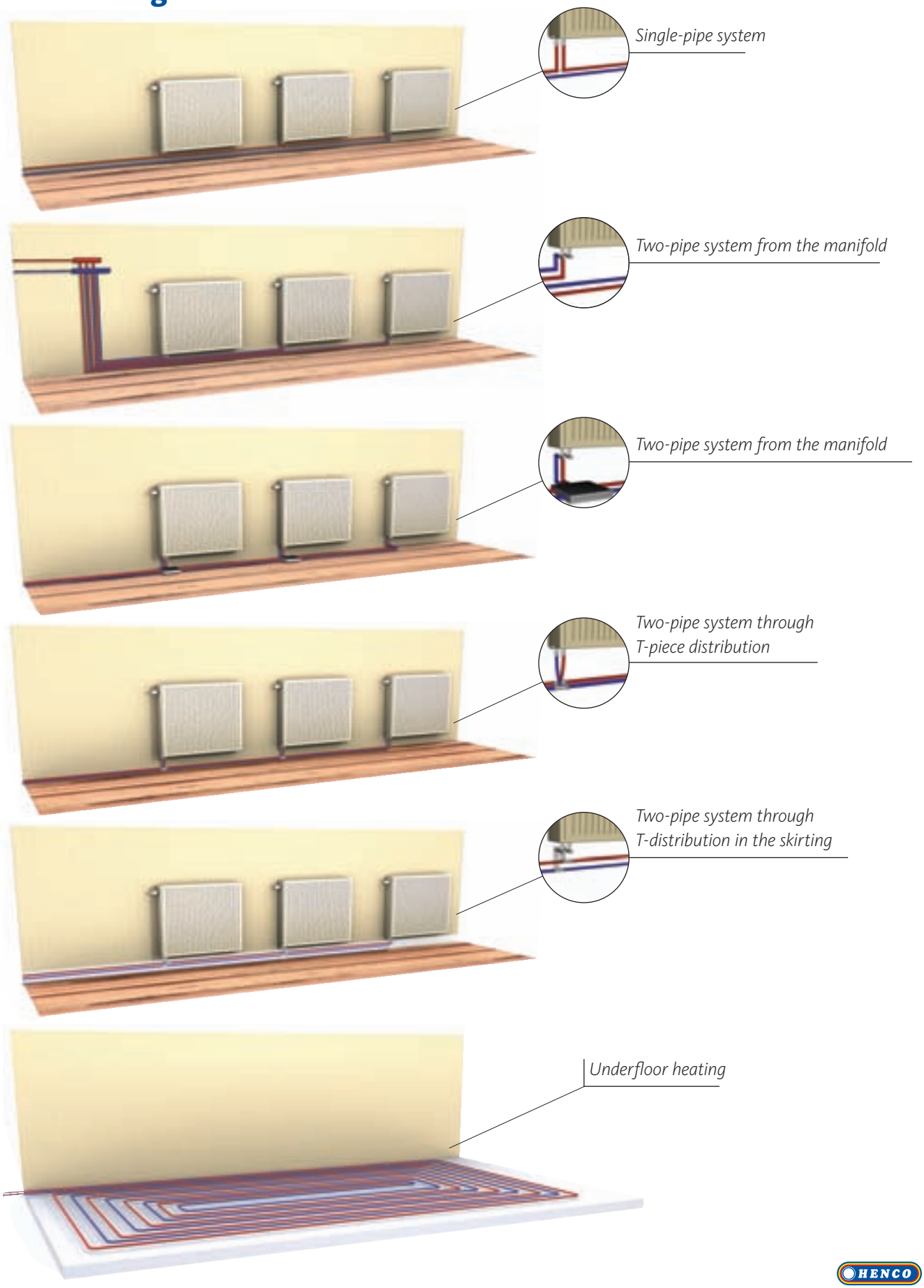


Ring pipe



All appliances are provided with hot or cold water by the same supply pipe. Branches are made using T-pieces.

9.2 Heating


Single-pipe system
Two-pipe system from the manifold
Two-pipe system from the manifold
Two-pipe system through
T-piece distribution
Two-pipe system through
T-distribution in the skirting
Underfloor heating